

## CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES

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### 4.1 INTRODUCTION

This chapter describes the predicted consequences, or potential effects, on the environment of implementing each of the three alternatives, described in Chapter 2, in association with potential Federal fluid minerals activities (e.g., exploration, development, production, and abandonment). The chapter begins with a summary of the methods used for the impact assessment, describes the impacts that are common to all alternatives, and summarizes the potential impacts that could result from each alternative.

Using the information regarding the existing condition of the environment (Chapter 3), a description of fluid minerals activities (Appendix B), and the reasonable foreseeable development (RFD) projected for the Planning Area (Appendix A-IV), the types of impacts that each alternative could have on the resources were identified and quantified only to the extent practical for this programmatic document. The inherent difficulty of a programmatic EIS is to describe potential impacts from a project action when exact locations of project sites are not known. In addition, frontier areas (new or incompletely investigated) or areas with low-to-medium potential for fluid mineral resources may lack more detailed analyses (e.g., probable locations, resource volumes) that are not feasible due to a lack of geologic data. It should be noted that no ground-disturbing activities will result directly from the alternatives addressed in this document. Although the issuance of a lease grants rights that could result in surface-disturbing activities (unless the leasehold is 100 percent no surface occupancy), further site- and project-specific environmental evaluation is required prior to final approval of the activities (per 36 CFR 228.107).

Impacts are defined as modifications to the environment, as it presently exists, that are brought about by an outside action. Impacts can be beneficial (positive) or adverse (negative), and result from the action directly or indirectly. Impacts can be permanent, long-lasting (long term), or temporary (short term). In the case of this analysis, long-term impacts are defined as those that would substantially remain for the life of a project and beyond (approximately 20 to 30 years). Short-term impacts are defined as those changes to the environment during development or construction activities that generally would revert to preconstruction conditions (except for tree growth) at or within a few years of the end of construction. Short-term impacts may range from one to three years in duration. Impacts can vary in significance from no change, or only discernible change, to a full modification or elimination of the environmental condition. Throughout this analysis, emphasis was placed on lease stipulations that could be applied to areas that are sensitive to potential fluid minerals activities in order to mitigate or eliminate impacts.

#### **4.1.1 Impact Types**

The analysis includes three types of effects (see 40 CFR 1508.7 and 1508.8) as described below. *Direct effects* are caused by the action and occur at the same time and place. *Indirect effects* are caused by the proposed actions and are later in time or farther in distance, but are still reasonably foreseeable. *Cumulative effects* result from incremental impacts of action when added to other past, present, and reasonably foreseeable future actions regardless of what person or agency (Federal or non-Federal) undertakes those actions. Reasonably foreseeable future actions consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur within a defined time frame and that will impact the same, or portions of the same, resource. Because this Resource Management Plan Amendment/Environmental Impact Statement (RMPA/EIS) is programmatic and the size of the Planning Area is large (nearly 7 million acres), it was not practical or economically feasible to describe all projects, actions, and developments within the Planning Area. Therefore, major past, present, and future actions and their relation to potential fluid minerals activities are addressed generally.

The analysis of unavoidable adverse impacts, short-term versus long-term productivity, and irreversible and irretrievable impacts is incorporated into the discussions in sections 4.2 and 4.3. If they are not discussed specifically, there are none.

In order to determine the vulnerability of resources to impacts, resources were evaluated in terms of the following general criteria:

- # Resource significance—a measure of formal concern for a resource through legal protection or by designation of special status.
- # Resource sensitivity—the probable response of a particular resource to project-related activities.
- # Resource quality—a measure of rarity, intrinsic worth, or distinctiveness, including the local value and importance of a resource.
- # Resource quantity—a measure of resource abundance and the amount of the resource potentially affected.

#### **4.1.2 Reasonable Foreseeable Development**

The reasonable foreseeable development (RFD) is a projection of the fluid mineral actions and activities, including development, that are likely to occur in the Planning Area over the life of the

planning period, which in this case is 20 years. This projection includes the number, density, type of wells likely to be drilled, and the surface use requirements (to project the amount of surface disturbance). The RFD for oil and gas and geothermal resources is explained in Appendix A-IV.

## Oil and Gas Resources

A summary of the RFD for oil and gas resources is shown in Table 4-1.

**TABLE 4-1  
TWENTY-YEAR PROJECTION FOR OIL AND GAS DEVELOPMENT<sup>a</sup>**

Type of Action	Number of Actions on Federal Lands	Area Disturbed <sup>b</sup>	Approximate Total Acres Disturbed	
			Short Term	Long Term
Geophysical (miles)	5,000	On existing roads and trails and off-road (1 acre/mile)	5,000	Minimal
Frontier Wildcat Wells	39	Drill pads and access road	351 <sup>c</sup>	101.4 <sup>d</sup>
Appraisal gas wells (offsetting wildcat wells)	12	Drill pads, access road, pipelines, and power lines	108 <sup>e</sup>	60 <sup>f</sup>
Gas development wells	30	Drill pads, access road, pipelines, and power lines	228.6 <sup>e</sup>	126.6 <sup>f</sup>
Oil development wells	60	Drill pads, access road, and power lines	484.8 <sup>e</sup>	268.8 <sup>h</sup>
Gas production facilities	3	5 acres/site	15	15
Gas transmission pipeline (miles)	100	3.6 acres initial disturbance per mile, 2.6 acres stabilized per mile	360 <sup>i</sup>	260 <sup>i</sup>
Bulk oil storage facility	3	5 acres/site	15 <sup>j</sup>	15 <sup>j</sup>
UIC well	3	Drill pads, access road, and power lines	27 <sup>k</sup>	15 <sup>k</sup>
Total Acres Disturbed			6,589.4	861.8

**NOTES:**

a Not County-specific

b Acreage estimates for each component from observed average disturbance in the Roswell/Carlsbad area as provided in Bureau of Land Management 1994 Appendix 18 unless otherwise noted.

- c Wildcat well - assume 6 acres (400 by 600 feet [122 by 183 meters]) for drill pad (including worker camp) and 3 acres per access road = 9 acres. The source of this assumption is recent drill pad requests from the Bennett Ranch Operators and assumptions based on historical data made in the Roswell/Carlsbad Resource Areas of the BLM (1994).
- d 2.4 acres per well not reclaimed immediately for all but three of the rank wildcats. Three of the wildcats are assumed to develop into production wells, which result in 5 acres per well not reclaimed immediately.
- e Appraisal and development gas wells - assume 4.4 acres drill pad and access road for all wells, 4.6 acres for associated pipelines and power lines for all producing wells, which are assume to be economic (all appraisal wells and seven development wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.
- f Production gas wells - 5 acres per producing well will not be reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not be reclaimed within a three-year period after initial disturbance.
- g Development oil wells - assume 4.4 acres drill pad and access road for all wells (20 wells per field), 4.6 acres for associated pipelines and power lines for only producing wells which are assume to be economic (16 producing wells per field). If a worker camp is needed, it is assumed that the one set up for the wildcat well can be used.
- h Production oil wells - 5 acres per well not reclaimed immediately. For the three wells per field that are assumed to be drilled but not economic, 2.4 acres per well are assumed not be reclaimed within a three year period after initial disturbance.
- I Gas transmission pipeline - 3.6 acres per mile (30 feet [9 meters] wide) and reclaim to approximately 2.6 acres (8 to 9 feet [2.4 to 2.7 meters] wide).
- j This facility could occupy the same acreage as the gas production facility or the UIC facility though the acreage for those facilities would increase. Therefore, for the purpose of estimating surface disturbance, all facilities are assumed to be separate.
- k UIC wells – assume a similar amount of acreage for drilling the well and constructing the facility as a production well (9 acres per well). Assume each well is reclaimed to 5 acres per well for long-term impacts.

Although location of future development is not assured, there is some information available. The recent gas discovery on Otero Mesa in southern Otero County suggests that location is likely to experience additional development. Maps 3-3 and 3-4 indicate that medium and low potential for oil and gas are distributed throughout the Planning Area.

The timing of development is unlikely to occur evenly over time and multiple wells could be developed in a burst of activity in the same general area, with field development within a period of two to five years.

## **Geothermal Resources**

Development over the next 20 years is expected to be on a small scale. In the RFD, it was assumed that over this period two temperature surveys of 30 wells each would be drilled. These drill sites would be located adjacent to existing roads and each site would disturb an area 25 by 25 feet (7.6 by 7.6 meters). Five other various kinds of geophysical exploration permits would be approved. Most of these activities would be conducted along existing roads and trails and would involve minimal surface

disturbance. Four test wells would be drilled and each would disturb an area of 1 acre and require an access road 1.5 miles long by 16 feet (4.9 meters) wide. Only one of the four test wells would be assumed to become a commercial greenhouse facility. The facility would require an area of 10 acres for development and two production wells (the original test well and another well). A total of approximately 26.6 acres would be disturbed from these activities.

Similar to oil and gas resource projections, the location of future geothermal development is uncertain. However, several areas of “high” potential for geothermal resources have been identified and are mapped (refer to Map 3-4). Within the Decision Area, these locations occur in the vicinity of Truth or Consequences, Hillsboro Arrey, and Derry in Sierra County.

#### **4.1.3 Mitigation Planning**

This assessment took into account the rules, regulations, guidelines, and best management practices or techniques (Appendix A-III) that would apply generally to all proposed projects and stipulations that would be attached to leases (Chapter 2, Appendices A-V and A-VI). In addition, as mentioned above, further site- or project-specific environmental evaluation is required at the time of an Application for Permit to Drill (APD). Any measures to mitigate impacts identified at that time would be attached to the APD as conditions of approval. The impacts remaining after considering and incorporating the above are considered residual, unavoidable impacts.

### **4.2 IMPACTS COMMON TO ALL ALTERNATIVES**

The following sections provide descriptions of the issues associated with each resource and the types of impacts from fluid minerals activities that have the potential to affect resources regardless of which alternative is implemented. Potential impacts that could result from each of the three alternatives are described in Section 4.3.

#### **4.2.1 Lands and Access**

##### **Issues**

In general, issues associated with lands that were identified during scoping focused on potential impacts on private property. Specific issues included the distance of potential fluid minerals development from existing residential and commercial uses, and potential impacts on cattle grazing operations and existing fencelines. In addition, private property in split estate situations was a concern. The development of Federal mineral rights in these situations may lead to land use conflicts if a private landowner is unaware of the severed mineral rights underlying his or her property. Split estate parcels in which the surface is

managed by another Federal or state agency may require coordination in order to comply with existing land use plans and policies.

Access was identified as an issue regarding the siting and number of new roads that would be required by fluid minerals development. According to existing BLM guidelines and public comments from scoping, it is desirable to use existing access roads to the greatest extent possible. Other access-related issues include road construction and traffic associated with fluid minerals development, the potential for an increase in accidents, and trespassing onto private property.

## **Common Impacts**

Types of potential impacts on lands and access were identified for the following situations:

- # Those areas where direct impacts are related to physical restrictions and loss of land. Uses with the potential to be impacted directly include grazing and recreation activities that occur on public land. Grazing and recreation impacts are addressed in later sections of this chapter.
- # Those areas where indirect impacts would include conflicts between fluid minerals development and residential or community areas related to the presence of truck traffic, dust, and noise.
- # Those areas where cumulative impacts related to transportation and access could result from additional traffic volume and associated increase in traffic accidents.

## **Lands**

Each alternative potentially could have short-term and long-term effects on State and private lands. However, the total number of acres disturbed in achieving the RFD is relatively small when compared to the total Federal mineral estate acreage (Table 4-2). Regardless of the alternative, the likelihood of leasing Federal minerals in a split estate situation is greatest within the Rio Grande/Mimbres/Gila River Basin (Map 3-6, Section 4.3.1), where approximately 20 percent of the Federal mineral estate acreage underlies primarily privately owned surface area.

No physical displacement or significant indirect impacts (dust, noise) are expected to occur in larger residential or community areas. Incorporated cities, towns, and villages are nondiscretionarily closed to leasing under all of the alternatives.

**TABLE 4-2**  
**SPLIT ESTATE BY HYDROLOGIC BASIN**

Split Estate Acres	Basin				
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/Mimbres/Gila River	Total
Private Land	91,910	42,033	5,189	212,314	351,446
State Land	6,342	3,062	568	5,098	15,070
Total	98,252	45,095	5,757	217,412	366,516
Percent of Federal Mineral Estate Acreage	7.9	2.1	1.4	19.4	5.3

SOURCE: Bureau of Land Management database 1998

NOTE: Refer to Map 3-6 and Section 4.3 for a description of hydrologic basins.

Military lands and National Park Service lands (outside of BLM's Decision Area), and public water reserves are nondiscretionarily closed to leasing in all of the alternatives. Other resource concerns include the White Sands Missile Range Safety Evacuation Zone, old Air Force bombing and gunnery range, and Recreation and Public Purpose Act (R&PP) Patents and Leases.

Impacts on utilities or other right-of-way concerns are not expected as a result of the construction and operation of the project alternatives. Pipelines needed for fluid mineral production most likely would be located within existing utility rights-of-way or within road alignments associated with well development, in accordance with BLM guidelines.

### Access

Acres of surface disturbance that would result from access road development are estimated in the RFD. This is based on a conservative estimate of 3 acres per well, which may vary based on the ultimate locations of specific activities. The total activity in the RFD relates to an estimate of 432 acres disturbed by access development for oil and gas development over the short term. Over the long term, these impacts may be mitigated through the reclamation of the land and revegetation. However, once access roads are developed it may be desirable to maintain them, should ranchers and others who use public land want to use the new routes.

It is conceivable that existing access roads, which traverse a great deal of the Planning Area, would be used by the fluid mineral development industry, which would reduce the impacts of new surface disturbance. This is more likely in the case of wildcat well drilling. For appraisal and development wells, the need for more permanent access probably would result in the desire to establish more direct routes to well sites rather than co-locating in existing corridors.

Impacts associated with access development may include the increased fragmentation of habitat and removal of vegetation. The increase in traffic along these routes may result in the introduction of noise

and other human activity that may affect wildlife and/or nearby activities such as recreation. A more detailed discussion of these impacts is included in Section 4.2.8.

Trips generated by each stage of fluid minerals activity (i.e., exploration, development, production, and abandonment) have been estimated based on previous oil and gas field development studies. Overall, impacts resulting from trips generated would be short term and largely associated with preproduction activities. As a result of the programmatic nature of this EIS, it is not possible to determine whether any variation would occur among the alternatives based on the specific well locations and roadways.

The closures of parts of US 54, US 70, and US 506 by the military may impact access to fluid minerals development locations for daily or emergency purposes, particularly in the Otero Mesa area. However, the schedule for closures is provided in Otero County and is available to the public for use in alleviating potential delays. The impact of recurrent closures of these major arterials on access to specific project facilities should be considered during APD processing.

Tables 4-3 and 4-4 indicate that the greatest amounts of additional trips are generated by the project alternatives in the short term. The number of trips for well maintenance may be considered a maximum estimate since the number of maintenance trips may decline as a result of efforts to decrease operating costs. When distributed evenly over time (20-year planning time frame), the maximum short-term impact adds a total of 655 trips per year, or an average of less than two trips daily. Given the average daily traffic volumes described in Chapter 3 and even distribution of well sites within the Planning Area, it is anticipated that none of the alternatives would increase traffic volumes significantly. It is possible that the RFD will be realized as a cluster of development rather than an even distribution, which might result in the consolidation of trips in an area or shared use of roadways.

**TABLE 4-3**  
**TRIPS GENERATED DURING WELL DEVELOPMENT**

<b>Phase</b>	<b>Estimated trips per site</b>
Well drilling	336
Well completion and testing	45
Wellsite facilities installation	31
Pipeline installation	181
Well maintenance	373 annual

SOURCE: BRW 1998



**TABLE 4-4**  
**TOTAL TRIPS GENERATED BY RFD**

<b>Activity</b>	<b>Number of Actions on Federal Lands</b>	<b>Total Estimated Trips</b>
Frontier wildcat wells	39	13,104
Well completion and testing	39	1,755
Production wells (facilities installation)	16	496
Transmission pipeline	2 sites, 75 miles	150
Well maintenance (production wells)	16	5,968 annually (approximately 16 trips daily)*
NOTE: * This figure does not assume that one truck would be used for maintenance on multiple sites, so the number of vehicles on the road is not necessarily reflected.		

SOURCE: BRW 1998

## 4.2.2 Minerals

### Issues

During scoping, the public expressed concern that the development of fluid minerals might increase the potential for land subsidence. As described below in Common Impacts, removing the fluids from within the rock formations typically would not affect land subsidence like the removal of hard rock minerals. The oil and gas industry is concerned that other resource concerns would limit their ability to explore for and develop oil and/or natural gas. While the geothermal industry has not expressed a similar concern, the same issue of potential limitations is possible.

### Common Impacts

The potential for the RFD to affect natural seismic activity in the area during any phase of a project's activities is minimal, as is the potential for natural seismic activity to affect RFD activities. The New Mexico Bureau of Mines and Minerals has reported that some earthquakes in southeastern New Mexico may be related to oil and gas activities; however, normal petroleum activities typically would not affect land stability. Maps of seismic risk for the United States indicate the location of the Planning Area to be at the lowest seismic hazard risk although other areas of the Rio Grande Rift from Socorro to Albuquerque have the highest seismic hazard risk in New Mexico (USGS 1994).

A discussion of potential impacts common to all of the evaluated alternatives by project phase follows.

### Preliminary Exploration Investigations

No exploration-related impacts on geological/mineral resources are expected within BLM's Decision Area.

### Construction Phase

No specific construction-related impacts on geologic or mineral resources within the Decision Area were identified. Potential impacts on health and safety such as high formational pressure and hydrogen sulfide can be predicted or evaluated based on knowledge of geological formations that are to be encountered during drilling.

### Production Phase

Production of oil and natural gas from one geologic formation would not affect the recovery of oil and/or natural gas from other geologic formations. The production of natural gas and oil under all alternatives is a beneficial irretrievable commitment of the resource as the produced natural gas or oil no longer would be available for future use. The amount of oil, gas, or heat produced would vary depending on the number of wells drilled in the field and the ability to recover the resource.

Geothermal resources are considered a renewable resource, as the heat source is not mined, but rather, groundwater is used to transfer the heat (the resource) to the surface. The removed groundwater can be reinjected or naturally recharged to be used again to retrieve the heat. The amount of geothermal production and the lifetime of the project would be dependent on the end use of the heat rather than the resource.

Oil and gas and geothermal activities could be located in parts of BLM's Decision Area where coal and/or sand and gravel or other construction materials are mined or potentially could be mined. Geothermal activities also could be located in areas favorable for hard rock mining. However, the production of natural gas, oil, or geothermal resources is not expected to be a significant impact on the other minable mineral resources within the Decision Area. The long-term areal extent of the RFDs (e.g., the acreage affected) for petroleum and geothermal activities is small relative to the Decision Area. After abandonment of the facilities and wells, exploitation of the other minerals still can occur.

Although subsidence has occurred as a result of water production in some areas of the country, subsidence in the Decision Area from fluid mineral or groundwater withdrawal associated with either

petroleum or geothermal activities is unlikely because the production zone typically occurs at a significant depth and/or the geologic units are relatively incompressible.

### Abandonment Phase

In general, plugging and abandonment of production wells is not predicted to result in any impacts on geological or mineral resources, but in fact would re-establish permanent vertical zonal isolation.

#### **4.2.3 Soils**

##### **Issues**

Issues associated with soils include concerns regarding damage to land and soil erosion resulting from fluid minerals exploration, development, and production. Another exists where fluid minerals activities affect soils on steeper slopes, typically greater than 30 percent.

##### **Common Impacts**

Impacts on soils from fluid minerals activities include both short-term and long-term impacts. Short-term impacts typically occur during the preliminary investigations, construction, and abandonment (reclamation). Impacts continuing beyond construction and into production are long-term and potentially permanent. Potential short-term direct impacts on soil resources include localized compaction, temporary loss of prime farmland, increased soil erosion, mixing of soil horizons, and contamination of soils from various pollutants. Unless mitigated, short-term direct impacts may result in indirect or long-term impacts on soils.

Indirect impacts include accelerated soil erosion, loss of topsoil, and increased sedimentation in streams from runoff following rainfall or snowmelt. Increased sedimentation may affect aquatic habitats, fisheries, and domestic drinking water supplies, clog irrigation systems, and degrade the aesthetic attraction of streams. Increased wind or water erosion of unstabilized, disturbed soils may result in the loss of topsoil and reduced soil productivity, also affecting the revegetation potential of those soils. Areas of prime farmland may be impacted by the conversion of agricultural production acreage to uses associated with project actions.

The following sections briefly describe impacts from fluid minerals activities common to all alternatives that may result in losses of soil resources or soil productivity.

## Preliminary Exploration Investigations

Field activities related to exploration have the potential to produce short-term impacts on fragile soil resources. The most common impact expected to occur is localized soil compaction and erosion due to the movement of exploration trucks and equipment across off-road terrain, especially in sloped terrain or fragile soils. Recent geophysical projects on Crow Flats have shown damage on low-angle slopes of 4 to 5 percent. Soils have a higher susceptibility to impact during periods of rain or drought. Soil compaction may lead to decreased short-term productivity and potentially to erosion if vegetation is affected. Potential long-term impact created by accelerated soil erosion due to increased wind and water erosion of disturbed fragile soils include loss of topsoil and increased sedimentation in streams.

## Construction Phase

Construction of the drilling site creates the greatest potential for impact on soils. As with the preliminary investigations, soils are more susceptible to impact during periods of rain or drought. Construction activities generally include the installation of a lease access road, well pad grading, and fluid reserve pit excavation. Predicted short-term impacts on fragile soils due to development includes increased or accelerated soil erosion, loss of topsoil, loss of prime farmland, and compaction. The use of petroleum-based drilling products or spillage of petroleum fuels has the potential to contaminate soils immediately around the drill site. Soil erosion may accelerate when vegetation is removed or damaged by compaction in areas disturbed by heavy equipment. Especially in sloped terrain areas, soil erosion also may accelerate in high traffic areas of the well pad, along access roads, or on portions of the well pad that have not been properly graded.

Specific areas of slope instability or failure have not been identified in the Planning Area; however, the potential for instability typically exists where slopes are greater than 30 percent. Steep slopes are present in Sierra County along the Fra Cristobal Range, Caballo Mountains, and San Andres Mountains. In Otero County, the potential for slope instability or failure includes areas along the Sierra Blanca, Sacramento Mountains, Brokeoff Mountains, and Guadalupe Mountains. Because surface disturbance on slopes in excess of 30 percent typically are avoided where possible, project activities would have minimal effect on slope stability. Where such disturbances cannot be avoided, mitigative measures implemented to reduce erosion and protect watershed resources typically are specified for the well/drilling site in the Surface Use Plan of Operation and approved by the BLM through the APD authorization process.

Potential long-term impacts include loss of topsoil, mixing of soil horizons, and impacts on subsurface soils resulting from the introduction of produced formation brine into unlined or leaking reserve pits.

Mixing of soil horizons may occur due to improper soil stockpiling of the soil profile during the development of the drill pad and reserve pits.

### Production Phase

Production activities potentially impacting soils include continuous use of the lease access road and areas immediately adjacent to the wellhead. Production phase impacts potentially would be long term as areas of the well pad and access road are maintained for vehicular traffic, resulting in periodic compaction. When the production is dry gas with no associated fluid, potential impacts on soils resulting from well production can include compaction, accelerated erosion, and loss of prime farmland. Associated fluid production or oil production increases the potential for spills/leaks from produced water and/or petroleum fluids (condensate or oil) storage and handling. On-site produced water disposal also could impact soil resources through increased erosion where water is discharged or from leaks and spills from on-site evaporation ponds. Leaks and spills of concentrated brines from evaporation ponds can impact the soil productivity in the short term and potentially in the long term. If flares are used, the area of the flare pit is susceptible to impacts on productivity.

Soils sustaining prime farmland, inclusive of nonirrigated areas, are shown on Map 3-5. Irrigated prime farmland is present in areas where a reliable water resource has been developed. These areas include the Rio Grande Valley of Sierra County and in the Tularosa River Valley and Crow Flats in Otero County. Well pad and access road development could remove some prime farmland from production for the life of the well (10 to 30 years), and potentially permanently. Loss of prime farmland may affect local economic conditions.

Compaction of soils can inhibit natural revegetation and potentially agricultural revegetation of disturbed areas. Loss of topsoil and a decrease in soil productivity from soil layer mixing and compaction impacts the natural vegetation supported in the area, which in turn may affect forage and habitat for wildlife.

### Abandonment Phase

Abandonment activities typically are conducted to restore or reclaim the resource that has been impacted during the drilling and/or production of the well. Reclamation activities include regrading and revegetating the previously disturbed site. Short-term impacts described as part of the construction phase are applicable during the abandonment phase of the project. Long-term impacts on soils are highly dependent on the reclamation success.

#### **4.2.4 Water Resources**

##### **Groundwater**

###### Issues

The public expressed concern that the exploration and development of fluid minerals potentially may contaminate or deplete the scarce water resources of the Planning Area. As the southern part of Otero County is not a declared groundwater basin, groundwater use is not regulated by the State in this area. Because water is scarce throughout the Planning Area, the perception that a new water user may be competing for the limited supply is of concern to current local water users. Additionally, due to the water scarcity the potential for contamination is of concern both within and outside the declared groundwater basins.

###### Common Impacts

Water needs of fluid minerals exploration and production are small, but due to the scarce water, impacts may result from the water requirements for drilling and development activities. Potential contamination impacts on groundwater resources may result during well drilling, waste management activities, and re-injection of produced water from fluid minerals development.

Impacts associated with the preliminary, construction, production, and abandonment phases of the project are described below.

###### **Preliminary Exploration Investigations**

Preliminary exploration activities typically do not encounter groundwater or require water to perform the activities. Therefore, no impacts on groundwater resources would occur during this phase.

###### **Construction Phase**

All alternatives would require water for well drilling and development, construction of roads, well pads, and dust suppression. The potential for impacts on groundwater quality would be limited to drilling, well development, and well testing activities.

Water requirements for a 5,000-foot water-based, mud-rotary-drilled well is approximately 168,000 gallons or 0.51 acre foot (letter from Burlington Resources dated June 21, 1999). In BLM's Decision

Area, all groundwater is appropriated with the exception of the undeclared basin in Otero County. The drilling and completion water needs for an oil and gas well typically would be purchased from already-appropriated water. However, a permit can be issued by State Engineer's Office (SEO) for a water well within the declared basin without new appropriation if the amount of water does not exceed 3 acre-feet for a definite period not to exceed one year, and only if the State Engineer finds that the proposed use would not permanently impair any existing water right (SEO 1995). Therefore, in general, water wells for water used during the construction phase anywhere in the Planning Area can be drilled and pumped without a need for appropriation. In the undeclared basin of Otero County, a permit also is not required. Groundwater aquifers that produce water at rates less than 15 gallons per minute (gpm) would not provide sufficient quantities of water for the construction phase without the use of storage tanks. A water supply well, if drilled to support oil and gas activities, often is turned over to the landowner, as appropriate with the State Engineer's rules and regulations of groundwater use (SEO 1995).

Water quality requirements for the construction phase typically are less than 3,500 parts per million (ppm) total dissolved solids (TDS). Therefore, with the exception of the majority of the Tularosa Basin, the groundwater found in most of the basin deposits in the Planning Area would be of sufficient quality for use in the construction phase (see Management Situation Analysis, Map 12, Distribution of Dissolved Solids in Groundwater).

When drilling through sections of high-permeability rock, losses of drilling fluids may occur in the formation (these are called lost circulation zones). When drilling through shale formations, losses of such drilling fluids typically are minimal. Drilling fluid, which often is referred to as "mud," is a mixture of water, bentonite clay, and polymers. Drilling mud also may contain chemical additives such as caustic soda or barite in amounts to adjust the characteristic of the mud. Additives to drilling mud are controlled and are further diluted by the formation waters. Some minor loss of cement in the formation also may occur during the drilling process as lost circulation zones are plugged or during the cementing of the casings. Impacts on groundwater quality associated with drilling muds or cementing activities are restricted to the immediate vicinity of the well bore (within a few feet) and are not considered to be substantial because of the very small volume of groundwater that could be affected.

A majority of oil and gas wells are stimulated by a process that hydraulically fractures the targeted or producing formation from the well bore. Hydrofracturing is conducted to enhance the permeability of the formation in the vicinity of the well. Water and polymers are pumped into the well at high pressures causing the natural fractures to open and/or creating new fractures. Pressures are monitored to control and ensure that fracturing is maintained within the targeted formation. Sand or other propellant material is pumped into the well with the water and remains in the fractures after the hydraulic injection pressure is reduced, thereby holding the fractures open and increasing the effective permeability of the formation.

Materials used to keep the fractures open are inert; therefore, no detrimental impact on groundwater quality would be caused by the hydrofracturing procedures.

The possibility of degradation of fresh water aquifers could result if leaks or spills occur from pits used for the storage of drilling fluids, or if cathodic protection wells associated with pipelines are installed in a manner that allows for the commingling of shallow surface aquifers. However, since impacts would occur only if the governing regulations fail to protect the resource, the impact is not quantifiable.

## Production Phase

### *Oil and Gas*

Production of an oil and gas well typically would not have a direct impact on groundwater resources. All oil and gas wells must have a casing and cement program that is planned and approved through the APD process in order to prevent the migration of oil, gas, or water from one horizon to another that may result in degradation of groundwater (43 CFR 3162.5). The surface casing must be set with sufficient cement to fill the annular space from the casing shoe to the surface and at sufficient depth to protect all usable water aquifers and provide adequate pressure control (Oil and Gas Order No. 2). Well casing programs also require isolation or coverage of oil and gas zones and any usable water sources. This requirement ensures that the interzonal flow of fluids behind the casing is minimized or precluded.

One potential impact of operation of an oil and/or gas well involves the associated gases. Both carbon dioxide and hydrogen disulfide are common associated gases of produced natural gas and oil. Carbon dioxide may cause corrosion by reacting with produced water to form carbonic acid. This condition may be precluded by sodium bicarbonate, which if present in produced water, may have a neutralizing effect on the acid. If corrosion is not monitored and corrected, the carbonic acid could corrode through the steel well casing. Once the acid is in contact with the cement in the annular space between the casing and the well bore wall, the cement would be dissolved and could form potential horizontal and vertical conduits within the annular space. Corrosion could provide a pathway for the natural gas and its associated gases to migrate into a groundwater aquifer. Methane is not a toxic substance, so it would not pose a health risk if ingested. However, methane within the aquifer could alter the aquifer to a reducing environment sufficient to encourage the production of hydrogen sulfide by anaerobic bacteria. Hydrogen sulfide is a toxic gas, and if present in sufficient quantities, it can present human health risks. Additionally, methane within the aquifer could preferentially migrate into the water well. If sufficient quantities of methane are present within a well or pumphouse, the methane could pose an explosive risk.



Mitigation and monitoring measures are used as standard practice in production wells to address this corrosive concern. Many operators treat for corrosion with active and batch chemical treatments, and some monitor for corrosion using coupons (pieces of metal, typically rectangular, of the same alloy as the casing) hung in the well.

As the conditions that would cause an impact are many and quite complex, it is not possible to quantify the impact. If a landowner's well is affected, the impact can be significant to the landowner; however, contamination is often localized. Based strictly on the potential lateral extent of the potential contamination, the regional impact on groundwater resources within the Decision Area would not be significant.

Water requirements in the production phase of oil and gas production is minimal to nonexistent. Instead, water can be a waste product of the production. Typically, natural gas wells make little water and the water produced can be disposed through the use of evaporation ponds. Oil wells tend to make water, especially in the later portion of the well's life as oil production declines. Depending on the quantity of the water, it can be disposed on site or off site. On-site disposal may include release to a surface water feature if water quality is sufficient, or use of evaporation ponds. Off-site disposal can include the use of permitted underground injection control (UIC) wells.

The potential for a disposal (UIC) well to impact groundwater quality is very low due to the casing and cement construction requirements in 40 CFR 146.22, which typically are met by filling all the annular space between the casing and the well bore with cement.

Injection of the produced water into a target zone with poorer quality than the produced water is consistent with BLM policy and the U.S. Environmental Protection Agency (EPA) UIC Permit Program (40 CFR Part 144). The formations used for water disposal must meet the following criteria:

- # the aquifer does not currently serve as a source of drinking water
- # the aquifer currently cannot, or will not in the future, serve as a source of drinking water because it is:
  - mineral, hydrocarbon, or geothermal-energy producing or can be demonstrated to contain minerals or hydrocarbons that, considering their quantity and location, are expected to be commercially producible
  - situated at a depth or location that makes recovery of water for drinking water purposes economically or technologically impractical

- contaminated to an extent that it would be economically or technologically impractical to render the water fit for human consumption

# the TDS content of the groundwater is more than 3,000 milligrams per liter (mg/L) but less than 10,000 mg/L and it is not reasonably expected to supply a public water system

Disposing of produced water by injecting it into a deeper, poorer quality aquifer would result in a loss of the resource within the original aquifer and potential degradation of the resource. Once the produced water has been injected into the disposal reservoir, it could be more expensive to retrieve than it was in a shallower formation. Also, it would be more saline than it was in the original formation due to mixing with the poorer quality of the disposal reservoir. However, the loss of the water from the producing formation does not constitute a significant impact because this produced water is not a water source. If TDS concentrations within the produced water are less than 3,000 ppm, the water typically would be put to a beneficial use or released to a surface water system to naturally recharge the water cycle rather than be disposed.

Disposal of production water by injection would increase formation pressures locally and generally decrease salinity within the formation of injection. Since all disposal wells are designed for “well injection” of wastewater, the wells are subject to the permitting and regulatory control provisions of the Federal Safe Drinking Water Act’s UIC Program (40 CFR Part 144). The New Mexico Oil and Gas Commission (NMOGC), with oversight of the EPA, administers and implements the UIC program in the Planning Area. A permit from the NMOGC is required prior to drilling a new well or recompleting an existing well. Injection pressures and volumes are monitored to ensure that potable aquifers are not affected adversely by injection of produced water. Potential cross-contamination of groundwater supply aquifers from disposal wells is unlikely because of the required use of appropriate well construction (e.g., entire well bore cased and cemented), restrictions on injection pressures, completion of mechanical integrity testing, and completion of detailed monitoring of produced and injected water volumes.

Potential accidental spills of produced water or leaks from evaporation ponds could result in an impact on shallow groundwater. However, due to the probable low volumes of spilled or leaked materials and localized geographic extent of such spills or leaks, the impact is not anticipated to be significant.

### *Geothermal*

Using water to convey geothermal heat to the surface requires a State-approved appropriation if the project is located within a declared groundwater basin. As an appropriation hearing would be conducted as part of the geothermal well permitting process, the impact of appropriation would not be

considered significant if the well is permitted by the SEO. Additionally, any fresh water supply wells for the facility also would have to be permitted and the water allotted by the SEO.

Once the heat is removed, typically through the use of heat exchangers, the water is reinjected or released. The SEO encourages the beneficial use of this wastewater. All reinjection wells must comply with the UIC program, as described above. Any chemical treatments to discourage scaling or reduce corrosion within the heat exchangers would need to be neutralized or approved with the UIC program prior to reinjection.

Water production from geothermal production would not affect the supply potential of the shallow domestic and stock use aquifers of the Planning Area. Geothermal water quality is likely to have higher TDS and may have other associated gases such as hydrogen sulfide and carbon dioxide. The same potential impacts of producing and handling petroleum-related produced water, described above, apply to geothermal produced water. Geothermal waters would be expected to be of poorer quality than the first available groundwater; therefore, surface spills and leaks from a production/injection well could degrade water quality. However, the impacts would tend to be limited to the area of the geothermal production facility and, therefore, probably would not be significant to the groundwater system. The geothermal production facility is likely to need fresh water also. Therefore, the facility would have an added incentive to ensure the protection of the groundwater supply.

#### Abandonment Phase

Little potential exists for fluid migration between formations after injection and production wells have been plugged and abandoned. Present-day methods used for plugging and abandonment of oil and gas wells reduce the potential of leakage and/or migration of fluids after abandonment.

### Surface Water

#### Issues

Issues identified regarding surface water include protection of surface water quality and quantity. Specific areas of concern are riparian and wetland areas, playas, and designated protected watersheds.

## Common Impacts

In general, direct impacts on surface water quantity or quality include sedimentation resulting from erosion during drill site, pipeline, and/or road construction or contamination resulting from spills. Indirect impacts may include contaminants migrating into the groundwater system and surfacing in the form of seeps or springs, or reduced flows due to water depletions.

Impacts on surface water resources identified for each phase of activity are expected to be the same but may vary in the degree of impact.

## Preliminary Exploration Investigations

Impacts related to field exploration activities are expected to be localized and short term. Decreased infiltration due to soil compaction by vehicle traffic and geophysical vibrosources trucks may lead to increased runoff, but the degree of impact on surface water is dependent on proximity to surface water bodies. Using existing stream crossings for vehicle traffic would minimize impacts on surface water resources.

## Construction Phase

The magnitude of potential impacts on surface water quality and quantity is dependent on (1) the extent of surface disturbance, (2) the hydrologic characteristics of disturbed areas, (3) runoff control measures, and (4) the proximity of well pads and rights-of-way to surface water bodies and their drainages. Impacts on perennial streams and rivers also are dependent on the time of year due to seasonal flow considerations and the actual lifespan of the construction phase.

## *Water Quality*

In general, direct impacts on surface water quality are related to the areal extent of surface disturbances associated with road or pipeline construction, and well construction. Well construction could affect surface water within the immediate vicinity of drill pads, whereas road or pipeline construction could affect surface water along the right-of-way corridors. These impacts generally would be localized and short term, and are related to accelerated erosion from storm events that occur when surface soil is exposed, such as during and after construction and earthmoving. Increased runoff and erosion also would have a detrimental impact on stream channels, leading to increased bank erosion, channel scour, and on- and off-site sedimentation.

The magnitude of impacts also is dependent on the time of year due to seasonal changes in rainfall and snowmelt runoff, and length of time the soil is exposed. Runoff events occurring while surface areas are exposed have the potential to increase streamflow and sediment production. Increased flows would have a self-perpetuating effect on the sediment yield by increasing bank erosion and channel scour, and changing the shape and sinuosity of stream channels. Those sites located in well-vegetated areas can expect little or no erosion effects beyond the immediate vicinity of the site. However, many of the impacts from the installation of roads and culverts can be long term.

Potential indirect impacts on surface water quality are primarily dependent on the proximity of the construction site (e.g., drill pad) to receiving bodies of water. Increased sediment production, particularly from storm events or snowmelt runoff, presents the greatest potential risk to surface water quality. The predicted small areas of disturbance associated with individual well development and an enhanced buffer distance of the development site from surface waters would minimize potential impacts. In addition, implementation of best management practices would mitigate erosion and sedimentation impacts.

Potential direct impacts on surface water quality also could occur from accidental contaminant releases associated with machinery fuels, lubricants, and drilling fluids used during the construction phase. Small bermed ponds, which are often lined, are used to contain these fluids in the event of an accidental release, thereby reducing the potential for migration off the site.

### *Water Quantity and Use*

Potential impacts on surface water resources also may occur as a result of depletions from water requirements for well drilling. All alternatives would require water for construction of roads, well pads, well drilling and development, and dust suppression.

The greatest water use would occur during the construction phase. Water is required for drilling, cleaning equipment, cooling engines, and other construction activities. The average amount of water used to drill and complete a 5,000-foot well has been estimated to be approximately 0.51 acre-foot (letter from Burlington Resources dated June 21, 1999). Under the RFD, expected water usage for both drilling and completion is not expected to exceed 12.24 acre feet per year based on the maximum number of wells estimated to be drilled in any one year (24 wells drilled per year [7 wildcats and 17 development wells] at 0.51 acre foot per well).

The primary water source is expected to be purchased from existing water allotments (surface and groundwater) or from a site-specific water supply well and would be trucked or pumped to the site. No significant impact on streamflow in ephemeral or perennial streams in the Planning Area is anticipated.

## Production Phase

Potential direct impacts on surface water quality during production could be caused by accidental releases of produced inferior quality water. Although most produced waters are brackish to highly saline, some are fresh enough for surface discharge and/or use. If produced water is to be discharged to surface waters, it must meet water quality standards and have a separate permit from the EPA National Pollution Discharge Elimination System. Produced water, which cannot be directly discharged (e.g., brackish/saline or of poor water quality due to entrained hydrocarbons or other contaminants), is either evaporated from lined pits or transferred into temporary storage tanks prior to transport to off-site disposal (e.g., disposal well). Produced petroleum fluids (condensate or oil) also are commonly stored at the well site prior to transport. Water evaporation pits and water and petroleum storage and transfers present potential for surface water contamination through spills. Evaporation pits can be susceptible to leaks and possible breaching if not maintained or built to accommodate residual stormwater runoff from the site. Spills and leaks can impact surface water directly depending on proximity, or indirectly via stormwater runoff and/or groundwater interactions.

Produced water, if not disposed on site, will be transferred to a centralized disposal facility. The facility may be either a large evaporation pond or UIC well. Impacts on surface water are similar to those associated with the on-site storage and disposal facility, with the exception that the scale of leaks or spills may be larger. These disposal facilities are permitted with the NMOGC and the New Mexico Water Quality Control Commission (NMWQCC).

Any indirect impacts on surface water flow associated with withdrawal of water during production would require a hydraulic connection between the geologic formation from which water is produced and an ephemeral or perennial stream channel. Due to the anticipated depths of production, water quantity is unlikely to be affected by production from oil and gas or geothermal resources.

## Abandonment Phase

Impacts from well abandonment would be similar to construction impacts and would result from grading and recontouring of disturbed areas associated with drill pads and access roads. Impacts would be mitigated using site reclamation. After grading the area to a useful layout, restoring the landform as near as possible to its original contour, and using erosion control devices, the area would be reseeded to minimize erosion.

Site restoration and abandonment would adhere to standards and requirements of BLM and APD conditions of approval. Regulations require that production wells be filled with drilling mud and cement.

Therefore, little potential exists for direct impacts on surface water from the flow of liquids or gases from within the wells.

#### **4.2.5 Air Quality**

##### **Issues**

Air quality could be affected by activities associated with fluid minerals exploration, development, and production.

##### **Common Impacts**

In general, impacts on air quality could result from fugitive dust from ground disturbance, emissions from equipment, release of underground gases, and well fires. Both the construction and use of roads and drill pads could contribute to the amount of atmospheric dust. Emissions from machinery and leaks or releases from wells or pipelines could result in airshed degradation. Blowouts and accidents during drilling and production could result in well fires and release of gases.

Since it is not clear the location and extent of each specific activity that may occur in the Sierra and/or Otero Counties, the emission factors presented in each of the following scenarios are general instead of actual pollutant concentrations. These emission estimates would be applicable for each specific activity throughout the two counties. Exact pollutant concentrations for specific activities at specific locations would not be known until atmospheric dispersion modeling has been performed. This modeling would incorporate dimensions, locations, frequency, and duration of proposed or existing activities. Such information is now available.

The following sections briefly describe impacts from fluid minerals activities common to all alternatives.

##### **Preliminary Exploration Investigations**

Most of the activities associated with the preliminary investigation phase do not emit significant amounts of pollutants into the atmosphere. Aerial photograph and map review (topographic, geologic, seismic, etc.) activities generally are conducted prior to on-site visits. Vehicle travel along established roads and off-road is the main source of particulate emissions. In some cases, preliminary investigations require small amounts of drilling and the use of explosives. These activities usually occur off established roads,

incorporate more and larger vehicles, may require creating new roads, and, therefore, may cause greater emissions into the air.

The EPA's *Compilation of Air Pollutant Emissions Factors* (EPA 1999) AP-42 Section 13.2.2 Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads like those likely to be present in the study area. The following equation is used to estimate emissions per vehicle miles traveled:

$$E = k(5.9) (s/12) (S/30) (W/3)^{0.7} (w/4)^{0.5} (365-p/365)$$

E = emission factor in pounds (lb) per vehicle miles traveled (VMT)

k = particle size multiplier (dimensionless) - 0.36 for  $PM_{10}$

s = silt content of road surface material (percent)—12 percent mean silt content for dirt rural roads

S = mean vehicle speed (miles per hour [mph])—mean speed assumed to be 35 mph

W = mean vehicle weight (ton)—mean weight assumed to be 2 ton (small) and 15 ton (large)

w = mean number of wheels—assumed to be 4 (small) and 10 (large)

p = number of days with at least 0.01 inch of precipitation per year— average of 60 days per year across the Planning Area

$$E = (0.36)(5.9)(12/12)(35/30)[(2/3)^{0.7}][(4/4)^{0.5}](365-60/365)$$

E = 1.6 lb/VMT for small vehicles

$$E = (0.36)(5.9)(12/12)(35/30)[(15/3)^{0.7}][(10/4)^{0.5}](365-60/365)$$

E = 10.1 lb/VMT for large vehicles

The emission factor for particulates ( $PM_{10}$ ) from unpaved roads from small vehicles (e.g., pickup trucks) is 1.6 lb/VMT. For drill rigs and significantly larger trucks the emission factor is 10.1 lb/VMT. The emission factor for large vehicles assumes a vehicle weight of 15 tons, vehicle speed of 35 mph, and 10 wheels. These emission factors would be used for vehicle travel over unpaved roads for all activities in the study area.

If the preliminary investigation requires the use of explosives, the following emission factors would be used. Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a  $PM_{10}$  emission factor for blasting of overburden of 0.52 lb/blast. Table 11.9-4 in Section 11.9, Western Surface Coal Mining presents a total suspended particulates (TSP) emission factor for drilling of overburden of 1.3 lb/hole drilled. The conservative assumption that TSP emissions equal the  $PM_{10}$  emissions would be used.



## Construction Phase

### Exploratory Drilling

Exploratory drilling includes upgrading or creating roads capable of supporting heavy drill rigs and associated trucks, clearing a drill pad area, erecting temporary storage tanks and crew housing, and installing power generators and associated equipment, drilling pits, etc. Also, there would be increased vehicular traffic bringing supplies, water, personnel, and equipment.

The AP-42 Section 13.2.3 Miscellaneous Sources, Heavy Construction Operations provides information on emission factors to assess particulate emissions from road construction. The road construction emissions include demolition and debris removal (drilling, bulldozing, truck loading and unloading of debris, truck travel), site preparation (bulldozing, scrapers, truck loading and unloading), and general construction (vehicular traffic). A conservative emission factor for construction activity operations is 1.2 tons of TSP per acre per month. This emission factor is not applicable for PM<sub>10</sub> emissions, therefore PM<sub>10</sub> emission estimates, which are assumed to equal TSP emissions, would be conservatively high. This emission factor was derived using soils with moderate silt contents, a medium activity level, and a semi-arid climate. This emission factor is acceptable for use in the study area.

### Demolition and Debris Removal

Table 11.9-4 in Section 11.9, Western Surface Coal Mining presents a TSP emission factor for drilling of overburden of 1.3 lb/hole drilled. Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a PM<sub>10</sub> emission factor for bulldozing of overburden of 0.75 lb/ton moved. The truck loading and unloading emission factor comes from Section 13.2.4, Aggregate Handling and Storage Piles. The equation for material handling is as follows:

$$E = k(0.0032) (U/5)^{1.3}/(M/2)^{1.4}$$

k = 0.35 for PM<sub>10</sub>

U = mean wind speed (assumed to be 5 mph)

M = moisture content (7.4 for sand)

$$E = 1.8E-4 \text{ pounds of PM}_{10} \text{ emitted for each ton of material moved}$$

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads. The emission factor for particulates (PM<sub>10</sub>) from unpaved roads from small vehicles (e.g., pickup trucks) is 1.6 lb/VMT.

## Site Preparation

Table 11.9-2 in Section 11.9, Western Surface Coal Mining presents a  $PM_{10}$  emission factor for bulldozing of overburden of 0.75 lb per ton moved.

The AP-42 Section 11.9, Western Surface Coal Mining, Table 11.9-4 provides a TSP emission factor of 0.04 lb per ton for scraper unloading of topsoil.

Table 11.9-1 in the AP-42 Section 11.9, Western Surface Coal Mining provides a  $PM_{10}$  emission factor of 0.6 lb/VMT for a scraper in travel mode.

Table 13.2.3-1 in the AP-42 Section 13.2.3, Heavy Construction Operation provides a TSP emission factor of 20.2 lb/VMT for scrapers removing topsoil.

The truck loading and unloading emission factor is  $1.8E-4$  pounds of  $PM_{10}$  emitted for each ton of material moved.

## General Construction

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads provides an equation to assess particulate emissions from vehicle travel on unpaved roads. The emission estimate of  $PM_{10}$  from unpaved roads from small vehicles is 1.6 lb/VMT and 10.1 lb/VMT for vehicles 15 tons or heavier.

A typical exploratory well site may have average dimensions of 350 by 300 feet (107 by 91 meters) and may be as large as 600 by 600 feet (183 by 183 meters). The reserve pit can be 200 by 200 feet (61 by 61 meters), depending on drilling depth. An average site size is approximately 600 feet by 600 feet (183 by 183 meters [approximately 8.3 acres]). Using the conservative TSP emission estimate of 1.2 tons per month per acre, clearing and creating a well site would generate approximately 10 tons of TSP per month (30 days) of activity.

## Field Development

For each new production well drilled, the emissions presented above for exploratory drilling would be duplicated. The main difference between the wildcat well and the production well is that the drill pad may be smaller. The emissions from demolition and debris removal, site preparation, and general construction generally would be the same.

The AP-42 Section 13.2.2, Miscellaneous Sources, Unpaved Roads emission estimate for  $PM_{10}$  from unpaved roads from small vehicles is 1.6 lb/VMT and 10.1 lb/VMT for vehicles 15 tons or heavier. The amount of vehicle traffic is assumed to remain moderate to heavy.

### Production Phase

Few heavy construction activities occur during the production phase. The largest particulate-producing activity is vehicle traffic.

At different times during the life of the well, pumping may be necessary to remove the resource from the ground. The pumps and associated power supplies generally are installed during this stage (additional power generators may be required to supply additional electricity for the pumps). If an area needs to be cleared, the bulldozing overburden emission factor for  $PM_{10}$  in Table 11.9-2 in Section 11.9, Western Surface Coal Mining of 0.75 lb/ton moved is used.

AP-42 Section 3.4, Large Stationary Diesel and All Stationary Dual-fired Engines covers emission factors for diesel engines with more than 600 horsepower (hp), primarily used in oil and gas exploration and production. Table 3.4-1 presents gaseous emission factors for these engines. These emission factors are averages using data from many manufacturers and duty cycles. The emission factors for diesel fuel generally are greater than those used for dual-fired engines so the diesel emission factors are used. The uncontrolled nitrogen oxide ( $NO_x$ ) (assume 100 percent conversion of nitrogen dioxide [ $NO_2$ ]) emission factor is 0.024 lb/hp-hr. The carbon monoxide [CO] emission factor is  $5.5E-03$  lb/hp-hr. The  $PM_{10}$  emission factor is 0.0007 lb/hp-hr. The sulfur oxides [ $SO_x$ ] (assume 100 percent conversion of sulfur dioxide [ $SO_2$ ]) emission factor is  $(8.09E-03) \times S$ , where S = percent sulfur in the diesel fuel.

Vehicular traffic would remain relatively constant, but generally at a lower frequency than during other well field stages.

### Abandonment Phase

When a well is abandoned, the well hole is filled with concrete and capped. There may be an increase in vehicle traffic due to additional cement truck traffic for a short time until the hole is plugged.

After the well has been plugged and capped, the well site is reclaimed. For surface reclamation, the TSP emission factor for overburden replacement from AP-42 Section 11.9, Table 11.9-4, Western Surface Coal Mine, 0.012 lb/ton would be used.

#### **4.2.6 Noise**

##### **Issues**

Noise sensitive receptors are land uses associated with indoor and/or outdoor activities that may be subject to stress and/or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, educational facilities, recreational areas, and noise-sensitive wildlife species. An appropriate noise environment is necessary to prevent activity interference and annoyance.

##### **Common Impacts**

Noise impacts associated with fluid minerals development vary according to the activities and processes used in exploration, development, and production phases. Construction phase noise levels would be associated with access roads and well pad construction, drilling, installation of compressor equipment, and construction of pipelines. Production phase noise levels would be associated with well completion and dewatering and compressor engine operation. Other production noise would be associated with well workovers and maintenance operations involving a variety of equipment and vehicles. Produced water not directed to a pipeline gathering system would be trucked to off-site water disposal wells or permitted evaporation ponds resulting in additional vehicle trips and noise.

##### **Preliminary Exploration Investigations**

During preliminary geophysical investigations, noise impacts are anticipated to be minimal and short term.

##### **Construction Phase**

Impacts from construction would be temporary and result primarily from heavy equipment operation and vehicle traffic. Ambient noise levels would increase as a result of clearing, grading, and construction of pads and access roads. Rigging up, drilling, and rigging down would generate noise at all well sites. Specific noise-generating activities would include hauling equipment and supplies to the well site, constructing rigs, drilling wells to the required depth, and removing drilling equipment. This work would generate noise from diesel-fired drilling rig engines, and noise from operation of drilling rig drawworks, such as braking.

Equipment may include truck-transported drill rigs, cement, pumps, water trucks, miscellaneous hauling and pick-up trucks, cranes, bulldozers, backhoes, and welding equipment. Construction traffic carrying materials and heavy equipment to well sites would cause a temporary increase in vehicular traffic noise on access roads. Well completion and testing also would generate noise. Operation of equipment for cementing well casing, fracturing the well, and flaring of gas at the surface during completion would produce noise as well.

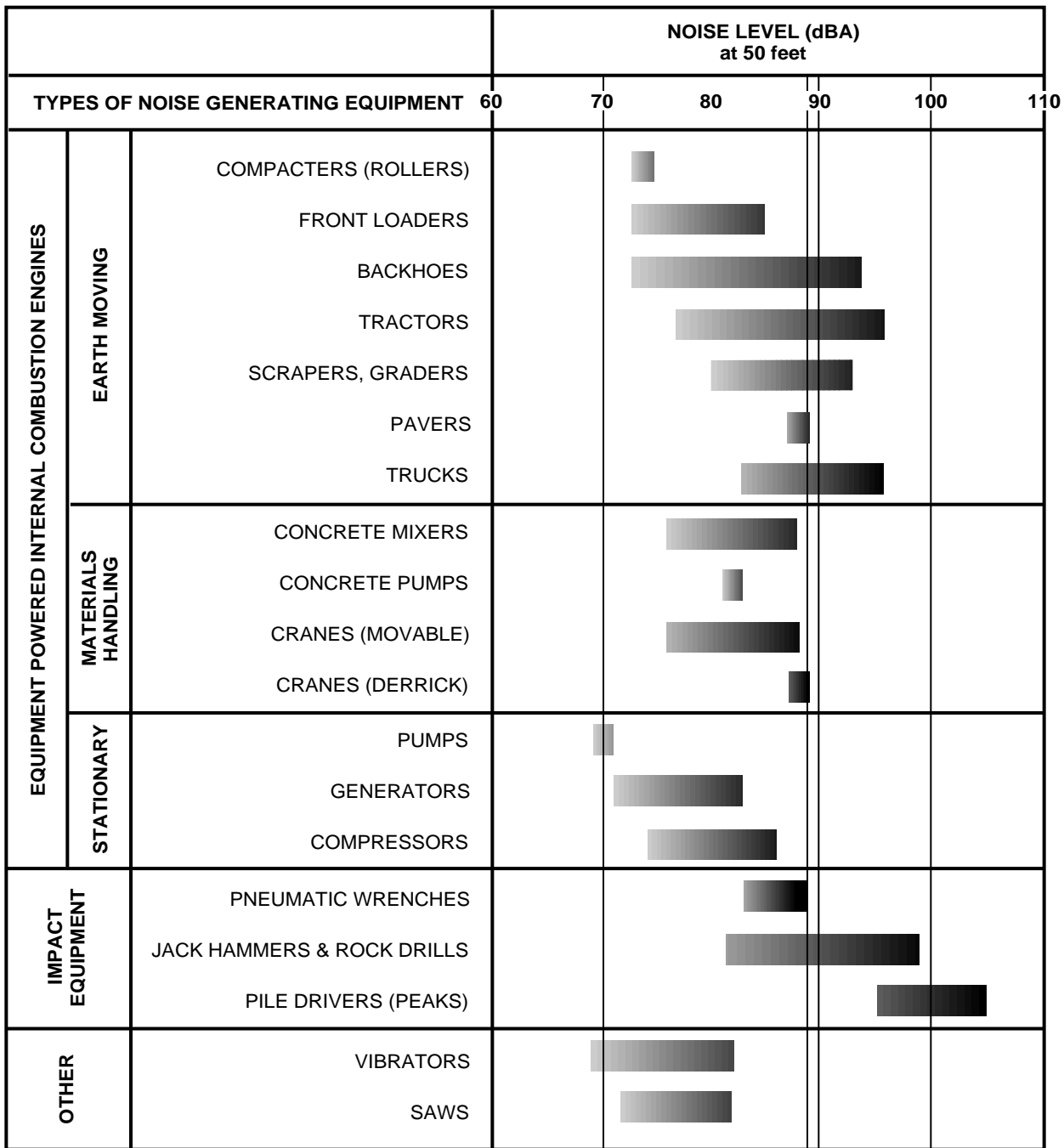
Typical noise levels from construction equipment and oil and gas activity are presented on Figure 4-1 and in Table 4-5. The sound levels shown are at a distance of 50 feet (15 meters). Estimates of noise attenuation can be made by reducing noise levels by a factor of 6 dBA (A-weighted sound levels) for each doubling of distance. This is a logarithmic relationship describing the acoustical spreading of a pure undisturbed spherical wave in air. The actual noise levels experienced by a receptor depend on the distance of the receptor from construction activities, topography, vegetation, and meteorological conditions. Residences located within approximately 2,800 feet (854 meters) and in direct line-of-sight to exploration and development activities could experience noise levels in excess of the EPA's 55 dBA guideline (EPA 1974). Recreational areas located within approximately 500 feet (152 meters) and in direct line-of-sight to could experience noise levels in excess of the EPA's 70 dBA guideline (EPA 1974). However, small percentage of the land area within the Planning Area is occupied by noise sensitive receptors; therefore, the overall potential for noise impacts on sensitive receptors (Figure 4-1 - Typical Construction Equipment Noise Generation Levels) is predicted to be low. Threatened and endangered wildlife species also could be significantly impacted if exploration and development activities occur within 1,600 feet (456 meters) of occupied habitat.

**TABLE 4-5**  
**NOISE LEVELS ASSOCIATED WITH OIL AND GAS ACTIVITY**

Noise Source	Sound Level and 50 Feet(15 Meters)*
Well Drilling	83 dBA
Pump Jack Operation	82dBA
Produced Water Injection Facilities	71dBA
Gas Compressor Facilities	89 dBA

SOURCE: Woodward Clyde 1988 (raw noise data)

NOTE: \* Sound levels are based on highest measured sound levels and are normalized to a distance of 50 feet (15 meters) from the source.



**Typical Construction Equipment  
Noise Generation Levels**

**Figure 4-1**

## Production Phase

Typical noise impacts during production would include light vehicle traffic related to well supervision and vehicle traffic and tasks associated with maintenance of surface production equipment. Maintenance tasks could involve pump trucks, welding trucks, backhoes, and wench trucks. These activities would be expected to generate noise levels in the range of 50 to 80 dBA at 50 feet (15 meters). In addition, it is anticipated that each well would be worked over using a truck-mounted rig on an annual basis. Noise levels from this source would be expected to be in the range of 70 to 90 dBA and normally would require one day per workover.

Compressor station operations represent the greatest noise source associated with production. As part of a similar study of oil and gas development, sound levels were measured at existing oil and gas facilities (Woodward Clyde 1988). The average day-night sound levels (Ldn) ranged from 44 to 69 dBA, the highest value being recorded at a distance of 500 feet (152 meters) from a compressor station. A summary of the measured levels is presented in Table 4-5 above. Maximum sound levels were corrected to a reference value of 50 feet (15 meters). Compressors can be designed and operated to reduce noise to acceptable levels. The duration of compressor station operation is anticipated to be the period of project life.

Residences located within approximately 2,800 feet (854 meters) and in direct line-of-sight to production activities could experience noise levels in excess of the EPA's 55 dBA guideline (EPA 1974). Recreational areas located within approximately 500 feet (152 meters) and in direct line-of-sight to could experience noise levels in excess of the EPA's 70 dBA guideline (EPA 1974). However, a small percentage of the land area is occupied by noise sensitive receptors; therefore, the overall potential for noise impacts to sensitive receptors is predicted to be low. Also, incorporated cities, towns, and villages are closed to leasing in all alternatives. Threatened and endangered wildlife species also could be significantly impacted if production activities occur within 1,600 feet (456 meters) of occupied habitat.

## Abandonment Phase

Noise associated with abandonment is from construction equipment used for plugging the wellbore and reclamation of the land surface to a stable and productive use. Sound levels would be less than those emitted during exploration and development. The potential for overall noise impacts on sensitive receptors is predicted to be low.

#### **4.2.7 Vegetation**

##### **Issues**

The primary issue related to vegetation is its protection and management, particularly native plants and habitat types associated with special status species and sensitive species (e.g., grasslands, woodland/forest, and riparian areas).

##### **Common Impacts**

Direct impacts on vegetation primarily result from clearing for drill pads, access roads, and pipelines. Also, direct impacts can occur from off-road travel by equipment, such as during seismic activities. Indirect impacts are associated mainly with accelerated wind and water erosion that affect areas adjacent to construction and earth-moving operations, and from contamination by fuels and solvents that are used during operations. The potential also exists for noxious weeds to be spread at the expense of native vegetation as areas are cleared for construction of various facilities. Cumulative impacts result from a combination of land uses that result in surface disturbances (e.g., road building) and in consumptive use of vegetation (e.g., grazing), which reduce the native species composition and promote the spread of non-native species, or reduce the vegetative cover on the ground surface.

##### **Preliminary Exploration Investigations**

Impacts on vegetation are attributed primarily to soil disturbance and damage to vegetation structure. The use of vehicles for off-road travel, such as for seismic exploration, would compact soils, increase soil bulk density, change thermal conductivity, and increase soil erosion. Changes in these factors can influence plant growth (Perez et al. 1999, Hausenbiller 1972). Higher compaction rates occur with wet soils and soils with multiple vehicle passes. Churning of soil by vehicle tires reduces soil strength and leads to erosion impacts. Furthermore, off-road vehicle travel can cause compaction and mortality of vegetation. On relatively flat terrain, there would be a small amount of mortality of herbaceous plants and short-term reduction of vegetative cover. Vehicles traveling on steeper slopes can severely churn and remove herbaceous vegetation. Off-road vehicle travel can push over shrubs; while this action is not likely to kill the plant, habitat structure and potentially valuable bird perching, feeding, and nesting substrates would be lost for long periods. Off-road travel generally increases soil erosion rates. Increases in erosion rates reduce soil structure and nutrient cycling, which reduces plant productivity. Such erosion also may affect receiving basins or areas that contain riparian and wetland communities. Reducing vegetation cover often increases the potential for weed species to become more widespread and problematic.



### Construction Phase

Impacts on vegetation during construction occur primarily due to clearing activities that are needed for well pads, roads, pipelines, and ancillary facilities. Clearing operations result in a reduction in the amount of vegetation (habitat) in the area and have the potential to increase wind and water erosion, which may affect adjacent areas due to increased soil deposition. Contamination of soil from fuel spills and leaks and drilling mud also may affect vegetation locally (including wetland and riparian vegetation).

### Production Phase

No additional impacts on vegetation would be anticipated during production. Accidental leakage of brackish/saline produced water could damage vegetation, which would be a long-term impact.

### Abandonment Phase

Revegetation of previously disturbed surfaces would occur during project abandonment. Grasslands generally recuperate relatively quickly, while other vegetation types (e.g., piñon-juniper) grow more slowly. No additional impacts on vegetation are anticipated during abandonment.

## **4.2.8 Wildlife**

### **Issues**

The primary issue related to wildlife is to provide adequate protection and management, particularly for big and small game and raptors, and associated wildlife habitat. During scoping, concern was expressed about potential impacts of increasing human disturbance on wildlife, and fragmenting habitat (e.g., by introducing roads) that may be important for wildlife movement. It was suggested that areas providing high-quality or unique habitat and wildlife habitat management areas should not be leased for fluid minerals activities. Also, protective stipulations were suggested for breeding areas, nest sites, and winter and year-long use areas.

### **Common Impacts**

The magnitude of impacts on wildlife depends on the time of year, location, and amount of surface disturbance, sensitivity and adaptability of the wildlife species present, and duration of human activities

associated with fluid minerals activities. Deviation in normal activity patterns and use of habitat by wildlife may affect the animal's energy budget and, therefore, the welfare and productivity of the animal if left uncovered.

Direct impacts on wildlife could include habitat loss and/or fragmentation, disturbance or displacement of wildlife, mortality of individuals, and hazards due to leaks or spills of or contact with harmful substances. Loss or fragmentation of habitat would result from clearing of vegetation to construct roads, well pads, pipelines, and other ancillary facilities. The magnitude of the impacts may be greater if the habitat affected is rare or used during critical time periods during the animal's life, or if the construction is near a water source used by wildlife. Increased noise and human activity may disturb or displace wildlife. Although wildlife species are likely to avoid areas where increased human activity is occurring, wildlife may be forced into less desirable habitat due to human presence. It also is possible to increase the number of animals into adjacent habitats beyond the carrying capacity of those habitats, potentially increasing the competition for limited resources. The increase in vehicular traffic, particularly during the construction phase, increases the potential for mortality of individuals. High mortalities in an area could result in a decrease of the prey base for larger mammals and raptors due to the loss of small mammals and reptiles. Vehicles and facilities at the well sites present possible hazards if leaks or spills of petroleum products occur. Contaminated evaporation ponds or reserve pits may be harmful to wildlife.

Indirect impacts on wildlife could include an increased potential for recreational traffic if roads are upgraded or new roads are constructed into areas that previously were relatively undisturbed, thereby increasing the disturbance to wildlife. Other indirect impacts include the secondary effects from habitat fragmentation and the potential for soil erosion to affect revegetation and/or to result in increased sedimentation into streams, thereby affecting the aquatic habitat of fish as well as degrading the water sources for wildlife populations.

*Habitat Fragmentation* Clearing of vegetation to construct roads, well pads, pipelines, and other ancillary facilities would result in fragmenting plant communities and wildlife habitat. This can result in direct, indirect, short-term, long-term, and cumulative effects.

Habitat fragmentation is the division of an extensive habitat into smaller habitat patches. Generally, the effects of habitat fragmentation include: (1) the reduction of the total amount of a habitat type and apportioning the remaining habitat into smaller, more isolated patches (Harris 1984, Wilcove et al. 1986, Saunders et al. 1991), (2) the creation of disturbed land which provides habitat for new, often exotic or weedy species (Harris 1984), and (3) the increase in the amount of edge to remaining communities. This increases predation and modifies plant composition even within the undisturbed area because of micro environmental changes. Such subtle modifications impact on insect and seed

production. Winter and Faaborg (1999) showed bird species in fragmented tall grass prairies were present but at lower densities and had lower nesting success than in unfragmented sites.

Helzer and Jelinski (1999) created a ratio between the amount of edge and the area of a grassland fragment. They then measured populations of six grassland nesting birds. They found, “species richness is maximized when patches are large (greater than 50 hectares) and shaped so that they provide abundant interior areas, free from the impact of edges.”

Typically, habitat fragmentation begins with the formation of gaps (e.g., cleared areas such as roads) in the vegetative cover of the landscape. As the gaps become larger or more numerous, the connectivity of the original vegetation cover is broken. Fragmentation creates a mosaic of communities different than species have adapted to over time (Noss and Cooperrider 1994).

Beyond the creation of smaller habitat patches, subtle processes occur when habitats are fragmented or degraded. Some effects of fragmentation may be conspicuous almost immediately following the disturbance of the habitat while other effects may develop over several years. In the long term, fragmentation alters the biodiversity of the landscape. Leach and Givnish (1996) recensused 54 prairie remnants and found that between 8 and 60 percent of the original plant species were lost from individual remnants over a 32-to-54-year period.

Such changes impact the composition of the wildlife community as demonstrated by the birds studied by Herkert (1994). He examined Illinois grassland fragments. He determined that avian species were influenced by habitat area and vegetation structure. Some species required a minimum size of a given plant community while others had to have a specific composition to the plant community no matter what the size. Both these features of grasslands are impacted by fragmentation. Fragmentation can select against some birds by having too small of a contiguous habitat and it can select against other species by causing a shift in plant community composition.

The disturbed areas that divide fragments of the original community are more prone to invasive exotic species that further alter the community makeup. As the plant communities change, the wildlife composition of the area also shifts. Species able to adapt to such disturbances are more successful than those associated with the original habitat.

Harris and Gallagher (1988) identify the following four major consequences of fragmentation for wildlife.

- # Loss may occur of area-sensitive species, those animals whose occurrence and successful reproduction are highly dependent on the size of the habitat patch in which they occur.
- # Larger species that have wide ranges and occur at low densities, such as large predators, may be lost due to increased harassment and encounters with vehicles.

- # There generally is an increase in exotic species or those species that readily adapt to human presence and disturbed habitats.
- # Inbreeding may occur if population numbers are low and populations are isolated.

Concern about fragmentation within the Planning Area is not limited to the potential effects of Federal fluid minerals activities being considered in this RMPA/EIS. Historic degradation of habitats in the Planning Area, particularly desert grasslands, is well documented. As mentioned in Chapter 3 (Sections 3.10 and 3.11), encroachment of desert scrub into grasslands has been occurring over the past 80 to 90 years. This shift may be attributed cumulatively to a combination of climatic change, introduction of roads, intensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975, Nielson 1986).

Of particular concern are two remnant desert grassland areas that provide important habitat for pronghorn within BLM's Decision Area (these coincide with the Otero Mesa Habitat Management Area and Nutt Antelope Area). The potential effects of Federal fluid minerals activities must be added to past degradation and impact of future activities. This could be a significant adverse impact if these cumulative effects occurred in the remnant desert grasslands. In an effort to protect remaining desert grassland habitat from further degradation in these two areas, BLM is proposing to employ a stipulation of no surface occupancy in remaining habitat patches, which are greater than 320 acres and limit fluid minerals development activities to areas within approximately 492 feet (150 meters) of existing.

#### Preliminary Exploration Investigations

As mentioned in the vegetation section above, the movement of vehicles hauling equipment over unpaved surfaces results in soil compaction, which reduces soil productivity and damages vegetation. Vegetation changes may result in a loss of herbaceous vegetation (i.e., grasses and shrubs) utilized as forage by wildlife (including pronghorn and mule deer) and changes in the bird prey base until the vegetation recovers. The type of soil and vegetation present determines the recovery time for the area. In addition, there could be a small amount of direct mortality of small mammals, ground-nesting birds, and reptiles due to increased vehicular travel. Small mammals constitute an important prey base for raptors. If crossings through washes or drainages are required, there is an increased potential for increased erosion and sedimentation in aquatic habitats downstream of the crossings, particularly during storm events. Washes and arroyos support more dense vegetation than surrounding areas; therefore, these areas provide habitat for migrating birds and resident species. Loss of vegetation would eliminate these resources, negatively affecting wildlife.

Generally, disturbances associated with geophysical exploration (seismographic activity) during noncritical periods of an animal's life cycle seldom cause significant impacts. These activities are of short duration with minimal habitat disturbance, which results in the temporary displacement of big game species. Studies conducted on the effects of sonic booms on wildlife populations indicate that, in most cases, mule deer and bighorn sheep exhibit minor behavioral reactions (Nevada Department of Wildlife [NDOW] 1989). Although there are some big game birthing areas present within identified herd unit boundaries, no specific birthing areas have been identified. If such areas are identified, effects of blasting and increased traffic during the birthing period could result in increased stress levels and decreased productivity of the animals.

Impacts on birds during the exploration phase could result in nest abandonment, loss of nests or potential nest sites, and elimination of important habitat components. Behavioral responses of birds are often influenced by increased human activity, although the responses vary between species of birds. Some individuals within a species may tolerate or habituate to a higher level of activity than others (Anderson, et al. 1990). Holthuijzen (1989) observed that prairie falcons in construction and blasting zones showed no differences in their overall behavioral repertoire, productivity, or occupancy of traditional nesting areas; however, those in blasting zones showed longer readjustment times and reacted more strongly to activity than those in the construction zone. Bednarz (1984) conducted noise studies on prairie falcons in the Caballo Mountains, and concluded that although the effects of short-term activities have been shown to be negligible, this cannot be assumed for the long-term effects of mining or blasting on occupancy of raptor nest sites.

Other birds, such as shore birds and waterfowl, showed a flight response to blasting and human activities, but appeared to habituate over time (NDOW 1989). Effects to most passerine species are anticipated to be negligible, although there is the potential for loss of nest sites.

### Construction Phase

As described above, impacts on wildlife during the construction phase would occur from the removal of vegetation (as forage, habitat, and cover) for well pads, roads, pipelines, and other facilities; and from disturbances from increased human activity. However, the effects of increased human activity are greater than the seismic explosion and equipment noises of preliminary exploration investigations (Barry and Spencer 1976 in Hay 1985). Effects on wildlife would be determined during site-specific studies for individual APDs; however, typical impacts associated with construction are described below.

Impacts could result in loss or degradation of habitat. Habitat loss ranges from the removal of vegetation during construction within a discrete area to the loss of viable wildlife habitat due to human intrusion, noise, and the isolation of habitats. This would result in the disturbance and displacement of

individual animals. The extent of effects on wildlife depends on the animal species, type and quantity of vegetation removed, and period of disturbance. Studies completed on the response of elk to drilling activities show varying degrees of severity. In Wyoming, elk moved 0.5 (800 meters) to 2.5 miles away often placing visual and auditory barriers between the herd and the well site (Hayden-Wing Associates 1990). Elk displacement away from activities has been shown sometimes to be significant (Johnson and Lockman 1980) and in other situations they appear to habituate to such activities (Brekke 1990).

The effect of habitat loss due to human disturbance is difficult to estimate for all species because each species differs in its tolerance to intrusion. Additionally, certain species are less tolerant of disturbance during critical time periods in their lives (i.e., nesting or fawning). If such areas are identified during site-specific studies for an individual APD, it may be necessary to alter the timing of construction to mitigate potential effects.

New road construction into previously unroaded or isolated areas could impact big game species significantly. Increased public access to these areas could result in increased legal take by hunters and higher levels of harassment, intentional (i.e., poaching) and accidental, to animals. This would be more critical if birthing areas are identified on a site-specific basis. The potential for deaths of big game species individuals would increase above existing levels due to increased traffic along existing roads. Also, direct mortality of some other wildlife individuals could be expected as a result of encounters with construction vehicles.

Activities adjacent to permanent water sources where waterfowl nesting areas may occur could cause nest abandonment and decreased hatching success, although this has not been well-documented. It is not anticipated that small birds, such as passerines, would be affected directly by activities associated with fluid minerals development.

During construction, aquatic and semi-aquatic populations (i.e., fish, frogs) in and downstream of the Planning Area potentially could be affected by any reductions in the quantity and quality of the surface waters. Well drilling requires the use of water, although water requirements should be met by purchase of already-appropriated groundwater or from a new water well approved by the State Engineer for drilling (refer to Section 4.2.4). Therefore, water usage would not impact fisheries through stream depletions. Fisheries resources are limited to a few sites in the Planning Area, including Caballo Reservoir, Elephant Butte Reservoir, portions of the Rio Grande, Three Rivers, and Tularosa Creek. Effects on fisheries could result from the removal of vegetation near or adjacent to the stream that could increase the potential for erosion and increased sedimentation especially following storm events. Fish populations could be affected adversely by contamination of surface waters from accidental spills or leakage of petroleum products from vehicles.

## Production Phase

Impacts on wildlife associated with surface disturbance generally are anticipated to be low to nonexistent during the production phase. Grassland areas that have been reclaimed following disturbance during construction would provide forage for larger mammals and burrow sites for small mammals and reptiles.

Activities associated with the operation and maintenance of the field vary, but some activities are continual, which could have adverse effects on wildlife although other studies indicate that impacts are minimal during this phase (Hayden-Wing Associates 1990). There is an increased potential for disturbance resulting from activities associated with operation and maintenance. It has been estimated that the expected zone of disturbance for elk and deer can extend for up to a 0.25-mile radius from a well site, road, or compressor station after construction activities have been completed. Disturbances caused by human activity and the presence of vehicular traffic associated with production and maintenance activities at well sites and compressor stations are anticipated to be low for antelope, deer, and elk. Bighorn sheep tend to be more sensitive to human disturbance; therefore, increased levels of activity could result in potentially higher effects.

The number of visits to compressor stations vary from visits per week to as much as two to five vehicle visits per day at larger stations. Servicing activities at well sites are generally intense for a short period of time, with an increase in human and motorized activity. Wildlife is likely to avoid these areas during servicing, if possible.

For oil and/or gas, construction of a large transportation pipeline is generally required to move the product from the well field to the market or refineries. Effects from pipeline construction vary greatly depending on the type of vegetation, terrain, and length of the pipeline.

Saline levels in produced water can be high and the water cannot be released into surface waters. Other disposal methods include subsurface injection, lined or unlined pits, and other BLM-approved methods. State and/or EPA permits also are required. Evaporation ponds and skimmer pits present a hazard to waterfowl and other wildlife that may be attracted to the water, which may contain residual materials such as oil or other chemicals.

## Abandonment Phase

Areas that were disturbed would be revegetated to a stable and productive state. Abandonment activities occurring near the sites could result in a short-term effect on nearby wildlife. Impacts associated with the increased noise and human activity during abandonment would be similar to those described for the construction phase. Closure of roads that are no longer needed would constitute a

beneficial effect on wildlife by decreasing the accessibility of the area to other traffic. Reclamation efforts of surface disturbances in the arid Southwest are not always successful due to variable climate and the presence of non-native species that are able to colonize a disturbed area. Revegetation of an area with native species may take on the order of 10s to 100s of years. Fragmentation effects that result in changes in community composition are long term.

Activities associated with abandonment should have no effect on fisheries populations except in areas where highly erodible soils occur in areas near streams or lakes. Measures to mitigate the effects of erosion would be effective in reducing potential harm to aquatic habitats.

#### **4.2.9 Special Status Species**

##### **Issues**

The primary issue related to special status plant and wildlife species (i.e., Federally listed, State-listed, and other sensitive species) and their habitats is to provide adequate protection and management. During scoping, concern was expressed about potential fragmentation of threatened and endangered species habitats, and it was suggested that fluid minerals leasing should not be allowed in habitats of threatened and endangered species.

##### **Common Impacts**

Effects on special status species are generally associated with ground disturbance and increased human access. Impacts that could affect special status plant and animal species are similar to those described for vegetation and wildlife in the previous two sections. Therefore, this section provides a summary of impacts specific to the different groups of special status species known or likely to occur within the Decision Area as a result of the RFD. The RFD projects the development of three gas fields and associated facilities. It is estimated that all phases of oil and gas development over 20 years could result in the short-term disturbance of approximately 6,589 acres. The type of habitat disturbed and the effects on species associated with those habitats would be determined on a site-specific basis when an APD is submitted and processed.

The following provides a general discussion about potential adverse effects on groups of special status plant and wildlife species. Descriptions of the mitigation measures that are required under the various lease stipulations and the special status species that have the potential to occur within each of the hydrologic basins are discussed under each alternative description. Detailed information about the natural history and status of each species is provided in Appendix D. Effects on Federally listed species are presented in detail in the Biological Assessment.



## Wildlife

*Mammals* Habitat suitable for one special status big game species, the desert bighorn sheep, occurs in the area. Areas suitable for the reintroduction of bighorn are located in the Caballo, Sacramento, Guadalupe, Brokeoff, and Cornudas Mountains. The Caballo Mountains provide a potential movement corridor for bighorn inhabiting the Fra Cristobal Mountains. Desert bighorn sheep are sensitive to human disturbance, especially during the breeding season. Increased access and human activity in bighorn sheep habitat could adversely affect the reproductive success of these animals. New roads and facilities could hinder the movement of animals and fragment suitable habitat. Placement of a field development in or near an area suitable for bighorn would likely eliminate that area from consideration for reintroduction of bighorn.

Small mammals include Arizona black-tailed prairie dog, gray-footed chipmunk, Guadalupe southern pocket gopher, desert pocket gopher, White Sands woodrat, and New Mexico jumping mouse. There is likely to be increased mortality of small mammals due to the loss of local habitat. They are generally not able to move away from construction areas as readily as more mobile animals and are more vulnerable to disturbance and loss of habitat. Adjacent habitat may be marginal or populations of other animals may already inhabit those areas making it unlikely for displaced animals to reestablish a viable population. Increased traffic in the area could result in increased mortality due to collisions with construction vehicles. Loss of burrows and vegetation for shelter also could make these small mammals more vulnerable to predation by larger mammals and raptors. The level of impact would be determined by the size of the existing populations of mammals and the availability of unoccupied suitability habitat adjacent to the development, as well as the mobility and sensitivity of the species.

The 10 species of bats present within the area are big free-tailed bat, occult little brown bat, pale Townsend's big-eared bat, small-footed myotis, cave myotis, fringed myotis, long-legged myotis, long-eared myotis, Yuma myotis, and spotted bat. A majority of these bat species occupy a variety of habitats within the area and would likely avoid areas during construction. They would be most vulnerable if construction occurs near roost sites or results in the loss of foraging areas. Water sources at the construction sites may attract insectivorous bats if the water is uncontaminated and supports increased insect populations.

*Birds* Special status raptor species in the area are northern aplomado falcon, peregrine falcon, ferruginous hawk, northern goshawk, and bald eagle. Owls in the area include western burrowing owl and Mexican spotted owl. Effects on raptors include loss or degradation of habitat, including nest sites, roosting sites, and foraging areas; lack of reproductive success due to nest abandonment in response to noise and increased activity; and a reduced prey base due to habitat loss in foraging areas. Different raptors species display varying tolerance levels for disturbances within their habitats. Additional effects of the proposed project on raptors during the different phases of exploration and development are provided under Section 4.2.8 - Common Impacts. Existing management guidance for raptors requires a

0.25-mile (400-meter) buffer around most active raptor nests. The buffer around an eagle's nest is 0.5 mile (800 meters) and is from 0.5 mile (800 meters) to over 2 miles (900 - 3,400 meters) for peregrine falcons, depending on the surrounding terrain. Site-specific surveys would be conducted when an APD is submitted and processed for to identify the presence of active nests.

Bird species, other than raptors, include mountain plover, Baird's sparrow, loggerhead shrike, southwestern willow flycatcher, and yellow-billed cuckoo. Increased noise and activity levels during construction and development could result in nest abandonment and decreased reproductive success if such activity occurs during the breeding season. The southwestern willow flycatcher and yellow-billed cuckoo are riparian species and any loss or degradation of such habitat would constitute a loss of potential breeding habitat for these species. Mitigation requires the avoidance of riparian and aquatic habitats; therefore, such effects are not likely to occur. Construction occurring in proximity to these areas during breeding may cause a disturbance to nesting birds and could reduce reproductive success. In the case where a proposed well site is in an area adjacent to riparian woodlands, surveys for active nests would reduce the likelihood of disturbing a nest site. Loss of grasslands would reduce nesting and foraging opportunities for mountain plover, Baird's sparrow, and loggerhead shrike. Loggerhead shrikes and Baird's sparrow occupy other habitats as well and could be affected by loss of resources in desertscrub and montane habitats, as well.

Shorebirds that may breed in the area are white-faced ibis, interior least tern and neotropic cormorant. Breeding areas are generally located along shoreline and marsh habitats near open water. The black tern is an uncommon summer migrant that forages in vegetated marshes. Construction and development would not affect these habitat types in accordance with proposed lease stipulations.

*Amphibians and Reptiles* Amphibians and reptiles in the area include the Texas horned lizard, gray banded kingsnake, mottled rock rattlesnake, Chiricahua leopard frog, and southwestern toad. Chiricahua leopard frog and southwestern toad inhabit riparian and wetland areas, which would be avoided by development. Road development and increased traffic that cross washes or arroyos would increase the potential for mortality of animals residing in those areas. The Texas horned lizard is associated with grasslands and deserts, as well as riparian and arroyo habitats. Both the gray banded rattlesnake and mottled rock rattlesnake occur in rocky areas within desert scrub, montane scrub, woodland/forest, and arroyo habitats. There would likely be some loss of suitable habitat for the horned lizard, kingsnake, and rattlesnake where development occurs. Increased traffic and human activity could result in direct mortality of individuals of these species inhabiting the area. The presence of new or upgraded roads and placement of facilities could cause the fragmentation of habitat or make it more difficult for these animals to move between areas of suitable habitat.

*Invertebrates* Mineral Creek mountain snail and Cornudas Mountains land snail are two special status invertebrate species that occur in the area. The Mineral Creek Mountain snail inhabits a very small area along Mineral Creek. Its habitat will not be affected by development because lease stipulations prohibit development along waterways. The Cornudas Mountains land snail is found within the Cornudas Mountains ACEC, although its range extends beyond the ACEC boundaries.

*Fish* Longfin dace is the only special status fish species likely to occur in the area. It is present in streams and drainages, which are protected by lease stipulations.

### Plants

Seventeen species of special status plants have been identified as occurring or potentially occurring within the Decision Area. Plants are susceptible to activities resulting in ground disturbance, as well as those that increase human access into an area. Increased human access into an area may result in the loss of plants that are collected for landscaping. Ground disturbance results in the direct loss of individual plants and may alter the habitat so that plants would not be reestablished. In many cases, non-native species are able to out-compete native species and successfully colonize a disturbed area. Construction vehicles may spread non-native species farther as they travel to and from the construction site. Increased human and vehicular activity would result in trampling and soil compaction. Trampling increases direct damage to plants. Soil compaction causes water to run-off rather than infiltrating the soil where it would become available for use by plants. Long-term effects of the loss of vegetation include erosion that can result in the loss and continued degradation of habitat.

The sensitivity of the habitat type and the extent of ground disturbance would determine impact levels. Some plants are more susceptible to disturbance, while others can withstand or even thrive in disturbed environments. When an APD is submitted, site-specific surveys will be required to determine which plants are or could be present. Effects could be long-term where plants are associated with habitats that are difficult to re-establish. Appendix C provides information on each species including known occurrences and associated habitat type(s). This information can be used to determine what surveys should be conducted prior to construction and development in a specific area.

#### **4.2.10 Rangeland**

##### **Issues**

Issues associated with rangeland and livestock grazing identified during alternatives development and through the public scoping process are related to potential effects on forage and short- and long-term carrying capacity, and maintaining grazing improvements and management facilities.

##### **Common Impacts**

Direct impacts on rangeland and livestock grazing are much the same as those described for vegetation and wildlife in Sections 4.2.7 and 4.2.8 above. Impacts on rangeland result primarily from removal of vegetation (forage) during clearing to construct roads, drill pads, pipelines, and other ancillary facilities. Off-road travel also causes vegetation damage, soil compaction, and associated decreases in soil productivity.

Indirect impacts include the potential for increased erosion rates in conjunction with vegetation removal and loss of topsoil in an area and sedimentation at a downgradient location, and the potential for water sources to be affected. Clearing existing vegetation often provides a pathway for the spread of noxious weeds, which can be harmful to the health of livestock. Other indirect impacts include disruption of existing grazing use, and the management of facilities such as fencing, water access, and livestock movement patterns. Cumulative impacts result from a combination of land uses that result in surface disturbances or interrupt existing grazing patterns and access.

In summary, surface disturbances reduce grazing capacity, and may change vegetation composition to include fewer forage species. Conversely, forage improvement can be implemented through revegetation.

##### **Preliminary Exploration Investigations**

Impacts on rangeland and livestock grazing during exploration consist primarily of vegetation and soil disturbance by off-road travel equipment. Off-road travel generally increases soil erosion rates, and causes compaction and rutting during wet conditions. These impacts reduce soil and vegetation productivity. If surfaces are disturbed and are not revegetated, they may provide an avenue for invasion by weedy species. Equipment operation also may disturb livestock or interrupt normal livestock movement patterns. Range improvements (fences, reservoirs, etc.) or land treatment projects (contour furrowing, seeding, or range monitoring sites) on public land should be avoided wherever possible.

### Construction Phase

Impacts on rangeland during construction result primarily from the direct loss of vegetation during clearing operations. Clearing and earthmoving also increase the potential for increased erosion and sedimentation that may affect water sources, such as stock ponds. Construction equipment may disturb livestock from traditional use or movement patterns. Contamination from fuel spills and drilling mud also may affect forage species locally.

### Production Phase

No additional direct impacts would be anticipated during production. Leakage of brackish/saline produced water could reduce the forage production and would constitute a long-term impact, as salt is difficult to remove once it becomes part of the soil.

### Abandonment Phase

Revegetation of previously disturbed areas with species that provide forage would occur during abandonment. Thus, impacts that originally occur in the exploration and production phases would be reduced.

## **4.2.11 Cultural Resources**

### **Issues**

The impact analysis addressed the issue of whether BLM's leasing program for Federal fluid minerals would directly or indirectly affect any significant cultural resources.

### **Common Impacts**

Impacts were assessed using criteria defined by regulations for *Protection of Historic Properties* (36 CFR Part 800). An effect is a direct or indirect alteration of the characteristics of a historic property that qualify it for inclusion in the National Register of Historic Places. Effects are adverse when the alterations diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association. Examples of adverse effects include the following:

- # physically destroying a property

- # inappropriately altering a property by not following the Secretary of the Interior's Standards for Treatment of Historic Properties (36 CFR Part 68) and applicable guidelines
- # moving a property from its historic location
- # changing the physical features within the property's setting that contribute to its historical significance
- # introducing visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features
- # transferring, selling, or leasing a property out of Federal ownership or control without adequate restrictions to ensure preservation

Review of inventory data indicated that archaeological sites are the type of cultural resources most likely to be affected by fluid minerals leasing. Ground disturbance directly associated with fluid minerals leasing is anticipated to have the most potential for adversely affecting archaeological sites. The introduction of visual, atmospheric, or audible elements into the setting of such sites is not expected to affect the scientific information of archaeological sites, but possibly could degrade the integrity of such sites if they have other historic values such as for public interpretation or for traditional cultural associations.

Other impacts may be indirect. Ground disturbance could result from overland travel that might increase as a result of fluid minerals activities enhancing vehicular access into an area. The simple increase of human presence in previously undeveloped areas also could result in inadvertent damage or intentional vandalism to archaeological sites.

It is anticipated that subsequent Section 106 (National Historic Preservation Act) reviews of individual projects undertaken as part of the BLM Federal fluid minerals leasing program would result in avoidance, minimization, or mitigation of any identified adverse effects. Any adverse effects on significant cultural resources that would not be avoided or mitigated through Section 106 consultations among the project proponents, BLM, State Historic Preservation Office (SHPO), and other consulting parties would be considered to be significant.

The aggregate extent of disturbance forecasted by the RFD over the next 20 years accumulates to about 10 square miles. Current inventory data indicate that 10 to 20 archaeological sites typically are present within each square mile of Sierra and Otero Counties. This suggests that under the worst scenario approximately 100 to 200 archaeological sites might be affected. The average density of archaeological sites varies across the landscape and the number of sites potentially affected could be greater or less depending on where activities are pursued. The potential to avoid impacts on most sites

is quite high, but as site density increases this potential is diminished. There is a high potential for satisfactorily mitigating impacts by conducting studies to recover important archaeological information before any unavoidable sites are disturbed, but such studies can be costly.

### Preliminary Exploration Investigations

Although the extent of ground disturbance resulting from geophysical exploration generally is characterized as relatively minimal and short term, many cultural resources, especially the type of archaeological sites found within the Planning Area, are quite fragile and even overland travel can damage such resources, especially if heavy equipment trucks are used.

Applicants for a permit to conduct geophysical exploration would be required to arrange for and fund an inventory of cultural resources that might be affected. Usually such exploration strategies are flexible and can be modified to avoid direct impacts on archaeological sites that may be present within the proposed exploration area. However, time and efforts are required on the part of BLM staff and the applicants to make such adjustments.

Although direct impacts usually are avoided by modifying geophysical exploration plans, individuals on field crews have been known to vandalize archaeological sites. In addition, geophysical exploration can result in informal two-track roads that can increase general public accessibility. Such enhanced access has resulted in inadvertent or intentional damage to archaeological sites in other areas managed by the BLM. The extent of such indirect effects is difficult to characterize, but they seldom are mitigated. However, BLM will take steps to minimize such indirect impacts by considering potential indirect effects in scoping resource surveys, working to control overland travel, limiting creation of informal roads, and educating work crews about penalties for unauthorized collection of artifacts.

The cultural resource inventories conducted for geophysical explorations would provide valuable information about the cultural resources present on public lands. However, the tendency is to conduct surveys only along the narrow transects of seismic lines and the resulting information often is less useful than the results of block surveys. The extent of survey (assumed to be 1 acre per linear mile of seismic line) would expand the average extent of annual inventory within the Decision Area by approximately 20 percent over the average rate of survey during the past one to two decades. However, exploration activities are likely to be sporadic and more intense during parts of the next 20 years. Therefore, staff review efforts are likely to be increased considerably more than 20 percent during some years.

### Construction Phase

During the construction phase, the ground-disturbing impacts described above could result from clearing, grading, and slope cutting activities required for upgrading and new roads, well pads, pipelines, and other ancillary facilities. Applicants for permits to drill would be required to arrange for and fund cultural resource surveys of areas potentially affected by these activities. Review of individual projects, modification of projects to avoid or minimize adverse effects, potential to avoid direct impacts, and potential for indirect impacts are all similar to those for geophysical exploration.

### Production Phase

During production, it is anticipated the amount of ground disturbance would be less than during construction. However, any new ground-disturbing activities (if needed) that were not permitted previously would require review and permitting. The potential to avoid direct impacts and the potential for indirect impacts are similar to those described above.

### Abandonment Phase

Activities associated with abandonment must take place within the area permitted for and disturbed by previous activities to avoid impacts on cultural resources.

## **4.2.12 Paleontological Resources**

### **Issues**

The primary issue related to paleontological resources is protection and management of potentially valuable paleontological resources.

### **Common Impacts**

Surface disturbance associated with geophysical exploration, construction of roads, well pads, pipelines, and other ancillary facilities may damage or destroy vertebrate or invertebrate paleontological resources that may be of scientific importance. The loss of the resource because of destruction or damage would be an adverse impact.



Indirect impacts may result from upgrading or constructing new roads that would increase the potential for access into areas relatively undisturbed previously. Improved access into areas could result in off-road travel, which may damage or destroy fossil resources. An increase in human visitations may result in vandalism of paleontological resources.

As previously described, ground disturbance associated with development of fluid minerals would occur in during preliminary exploration investigations and construction. Limited disturbance is expected to occur during the production and abandonment phases.

Many portions of Sierra and Otero Counties have not been explored or surveyed for paleontological resources; therefore, effects on paleontological resources would be determined during site-specific reviews for geophysical exploration and for individual APDs. With adherence to the BLM requirements for surveying and evaluating paleontological resources, no adverse impacts on these resources are anticipated.

#### **4.2.13 Recreation**

##### **Issues**

The primary concern related to recreation is the potential for the displacement or significant alteration of existing recreation opportunities due to land requirements associated with fluid minerals development. Through scoping, issues raised included providing for the availability of recreation and preserving or enhancing the public's access to recreation. Most of the BLM-administered land in the Planning Area includes recreation among the multiple uses.

The BLM has identified specific recreation resources of concern. These include some sections of the Tularosa River and the Red Sands Off-road Vehicle (ORV) Area. Areas of Critical Environmental Concern (ACECs), the Cornudas and Cuchillo Mountains areas, and Lake Valley Backcountry Byway also have been identified for consideration of impacts on recreation opportunities as well as visual resources.

##### **Common Impacts**

Two major impacts on recreation resources could result from fluid minerals activities. First, the displacement of recreation areas may occur in order to locate well or production facilities. Second, a change in the character of outdoor recreation opportunities may occur as a result of proximity to facilities and the associated dust, noise, and human activity.

Under the RFD, the total acreage disturbed for oil and gas development is estimated to be 6,589 acres in the short term and 862 over the long term. Geothermal development is anticipated to disturb a total of 26 acres. All fluid minerals development is associated with the introduction of motorized activities. However, it is unlikely that fluid minerals development would significantly displace the opportunity for primitive recreation due to its informal and dispersed nature and the small amount of acreage that is required to achieve the RFD relative to public land available.

The areas that are primitive in character and are closed to ORV use often correspond with Wilderness Study Areas (WSAs) or ACECs, which are designated as such due to notable natural or scenic qualities. These areas are already closed to leasing (see Section 4.2.15).

#### **4.2.14 Visual Resources**

##### **Issues**

The primary visual resource issues surrounding fluid minerals leasing in Sierra and Otero Counties are the degree of visible changes to the characteristic landscapes within local and regional viewsheds, preservation of scenic quality of the landscape, and compliance with Visual Resource Management (VRM) classifications. Specific issues identified in scoping include the protection of visually sensitive locations such as the Otero Mesa, Sacramento Escarpment, and mountain foothills.

##### **Common Impacts**

With implementation of any of the alternatives, direct impacts on visual resources could include adverse effects on the character of sensitive settings and on residential, recreation, and roadway views. Types of impacts on visual resources as direct or indirect result of the project could include short-term and long-term adverse effects on the visual character of the setting.

Long-term, direct impacts include the removal of vegetation, changes to existing landform through site grading, and the addition of structural elements into an undeveloped setting visible from sensitive viewsheds. Short-term, direct impacts primarily would include actions associated with construction, such as increased dust, and the presence of temporary drilling equipment and associated lighting that would allow for work to occur 24 hours a day. Indirect impacts on visual resources include the potential for increased recreational traffic on access roads.

Potential impacts from project activities relate to project visibility and the introduction of elements of different form, line, color, and texture into the landscape. The extent of noticeable change to the form,

line, color and texture of the landscape as a result of project exploration, construction, production, and abandonment can be measured in levels of visual contrast. The contrast levels (strong, moderate, and weak) and types of visual contrast that could result from the project components are defined as follows:

- # Strong—strong contrast occurs where project activities would attract attention and dominate the landscape setting.
- # Moderate—moderate contrast occurs where project activities are noticeable and start to dominate the setting.
- # Weak—weak contrast occurs where project activities would be noticeable but would not attract attention, and would be subordinate to the setting.

Components of the project with the highest potential to adversely affect visual resources include the visual character of the well pad and pipeline right-of-way clearing, as well as large solid components associated with oil and gas separation, treating, and storage facilities.

#### Preliminary Exploration Investigations

Activities associated with preliminary investigations could vary widely depending on the type of survey conducted. Gravity, geomagnetic, and seismic reflection surveys result in little or no surface disturbance or other visually evident impacts. Vibrosound surveys, however, require the use of several ORVs that compact soils and vegetation. The compacted, disturbed areas created from this type of survey can take many years to revert to pre-existing conditions depending on the type of soils and vegetation impacted. Drilling and explosive surveys, whether surface or subsurface, do not result in any long-term visual impact. Subsurface charges are installed with small-diameter drills to depths of 100 to 200 feet (31 to 61 meters), and result in little or no surface disturbance other than the drill hole itself.

#### Construction Phase

While impacts from exploratory drilling are usually short term, they typically would result in some of the most noticeable visual contrast. The greatest amount of human, vehicular, and equipment activity occurs during construction and drilling activities. Thirty to forty truckloads carrying equipment and/or water typically are necessary for the drilling of each well site. Drilling operations continue 24 hours a day and 7 days a week, and are accompanied by considerable noise and highly visible activity. Drilling activities, equipment, dust, traffic, and road construction likely would attract the greatest amount of attention during this phase. Similar to the preliminary exploration investigations phase described

previously, visual impacts created during the exploratory drilling phase would vary depending upon the methods used. For example, wildcat wells require larger drilling rigs (plus or minus 160 feet [49 meters]) with support facilities and may disturb a larger surface area than the area required for development wells.

Impacts on visual resources during field development primarily would occur from the removal of vegetation for well pads, roads, and other facilities; the addition of structural elements into a relatively undeveloped landscape; and potentially unnatural grading transitions within rolling or steep terrain. Major components of the analysis include the addition of structural elements into the landscape and vegetation modifications. Vegetation contrast results from clearing trees, shrubs, and grasses, and primarily is related to the density and type of vegetation cleared. Structure contrast results from the introduction of alternative facilities and primarily is related to the distance from which the well components are viewed. The typical structures associated with development such as well heads, condensate pits, meter houses, and chain link fencing are most dominant in the immediate foreground (0 to 300 feet [0 to 92 meters]) and less dominant in foreground views (300 feet [92 meters] to 0.25 mile [400 meters]). Well-related facilities become subordinate to the characteristic landscape in middleground views (0.25 mile [400 meters] to 1 mile), and noticeable to the casual observer in background views (1 to 5 miles). Other less common facilities (i.e., only one of these facilities would be required per development area) include larger facilities associated with resource processing treating and storage, and are more visually obtrusive.

### Production Phase

The occurrence of adverse impacts identified under construction for the potential well sites would continue to occur during production.

### Abandonment Phase

At this phase, reclamation would be required for any surface disturbed that is not needed for continued well operation. Long-term positive effects on visual resources would result from abandonment and reclamation including recontouring and revegetation of well pads, and pipeline and flowline paths. No additional impacts on visual resources in form, line, color, or texture are anticipated during abandonment.

#### **4.2.15 Special Management Areas**

##### **Issues**

During scoping, it was expressed that special management areas such as WSAs and ACECs should be protected from impacts associated with fluid minerals development. The WSAs in the Planning Area are managed according to BLM Manual H-8550-01, the Interim Management Policy and Guidelines for Lands Under Wilderness Review, commonly known as the IMP. The IMP directs nondiscretionary closure to leasing. The ACECs within the Planning Area were designated by the Otero County ACEC RMPA (BLM 1997) and were discretionarily closed to leasing. Also, management of the eight nominated ACECs in BLM's Decision Area included those reasonable measures necessary to protect significant resource values until the area is fully evaluated through the resource management planning process.

Management for fluid minerals development in McGregor Range also is previously determined, in the McGregor Range RMPA (BLM 1990). The decisions described in that document will be carried forward unchanged.

##### **Common Impacts**

Because the WSAs, ACECs, and the majority of McGregor Range are closed to leasing, there would be no direct impacts on those areas. There may be indirect impacts on biological or visual resources within special management areas as a result of project activities occurring on adjacent leaseholds. The potential for such impacts is discussed in the respective resource sections.

#### **4.2.16 Social and Economic Conditions**

##### **Issues**

The principal socioeconomic issues associated with the alternatives arise from potential changes in land use, employment of labor and capital in exploration and development activities, and generation of revenues in the form of royalties and taxes. If economic development is anticipated to be significant, related impacts of growth and the ability to provide required community services may become concerns.

The issue of environmental justice is included in this section. Title VI of the Civil Rights Act of 1964 and related statutes ensure that individuals are not excluded from participation in, denied the benefit of, or subjected to discrimination on the basis of race, color, national origin, age, sex, and disability. Executive

Order 12898 on Environmental Justice directs that programs, policies, and activities not have a disproportionately high adverse impact on affected minority or low-income populations.

## **Common Impacts**

Socioeconomic impacts generally result from disturbances to customary living patterns of the inhabitants of an area where some activity is proposed that will involve significantly altering conditions and uses of the local environment. In this analysis, impacts could occur in areas where leasing of Federal lands for exploration and development of fluid minerals would lead to clearing patches of land and temporary or permanent placement of facilities for finding and extracting oil, natural gas, or geothermal fluids. Current uses of such lands would be displaced, including livestock grazing, hunting, and recreational uses. Loss of such uses, often temporary, would involve depriving individuals of the economic or cultural benefits of customary uses. Mitigating measures may be necessary to compensate such persons with established property rights on the affected lands.

Besides these displacement impacts, there would be positive economic impacts from the employment and wages generated directly by the exploration and, particularly, development activities as well as the secondary (i.e., indirect and induced) effects on local businesses from spending by workers and contractors in communities in the vicinity. State and county governments would benefit from royalties on any production, while local governments would continue to accrue revenues from Federal government payments in lieu of property taxes on the leaseholds and other Federal lands in the counties. Cumulative impacts would occur in the event that fluid mineral development is anticipated to produce a boom-bust effect on local economies, potentially in conjunction with other proposed projects.

An important concern for socioeconomic impacts is the frequency and dispersion of exploration and development activities. The more concentrated they are in time and space, the more likely that local communities would experience a mix of beneficial and adverse effects. It is true, however, that any adverse disturbances would be of relatively brief duration, while the fiscal benefits would be long term.

Impacts on specific communities cannot be determined at this time due to the programmatic nature of this EIS; however, clusters of population that may be affected can be identified. If adverse impacts are anticipated, the potential for environmental justice concerns can be assessed by identifying clusters of the population that are characterized by a disproportionate number of minority or low-income residents.

## Environmental Justice

Environmental justice concerns are based on the location of well facilities, which could produce positive economic benefits or adverse impacts if the sites disproportionately impact minority or low-income communities (refer to Table 4-5). Demographic information for population centers in each county suggests that many of the larger communities reflect racial and income characteristics of the counties as a whole. A notable exception, however, is the Mescalero Apache Indian Reservation including the town of Mescalero, and the town of Tularosa. These areas comprise disproportionate percentages of minorities (American Indian and Hispanic), lower median incomes, and a higher percentage of the population with incomes below the poverty level. Significant adverse socioeconomic impacts are not anticipated; however, any specific environmental justice concerns may be addressed on a site-specific basis in the APDs.

## **Oil and Gas**

Impacts of oil and gas activities common to all alternatives include the land and labor needs, costs, revenue, and royalty rates associated with achieving the RFD. This section illustrates a likely scenario to accompany the RFD.

## Preliminary Exploration Investigations

Exploratory investigations are associated with certain financial risks and are not anticipated to generate returns every time. No significant socioeconomic impacts are anticipated during this phase.

## Construction Phase

One oil or gas well and its associated pad and infrastructure occupies 9 acres of land (based on well sites on the Bennett Ranch Unit), and can cost anywhere from \$600,000 to upwards of \$2 million to equip, drill, and complete (dry hole or successful). In 1997, the average cost for a completed onshore exploration well in the continental United States was \$1.685 million, drilled to a depth of 8,900 feet (EIA 1998). The average cost for a dry hole was \$2.042 million (average depth 10,400 feet). Development wells were less expensive—completed wells averaging \$870,000, drilled to 7,400 feet; dry holes averaging \$668,000, drilled to 6,400 feet (EIA 1998). An onshore well typically could be completed in less than a month's time, employing two crews of a dozen or more workers splitting 12-hour shifts around the clock (and oftentimes living in a remote work camp, to maximize worker productivity).

For purposes of this programmatic impact assessment, it was assumed that a maximum ("worst-case") development scenario would consist of two drilling rigs drilling simultaneously over a period of approximately four years.<sup>1</sup> This scenario presumes that if a promising strike were to occur, the operator would quickly drill additional wells near the strike to define the field. In such an instance, it is possible that as many as a dozen wells could be drilled in a wellfield area within a few months' time.

Specifically, the RFD scenario envisions 39 wildcat wells (three of which are successful), and four appraisal wells for each successful wildcat (see Table A-5). Subsequently, 30 gas development wells and 60 oil development wells would be drilled. The total number of new wells that would be drilled in Sierra or Otero County (or both) would be 141. Geographical concentration of activity would, of course, increase the scale of impacts on a local area. Using a nominal cost of \$1.3 million per well (the unweighted average of the cost figures cited earlier), the maximum development scenario would yield a total outlay of \$183.3 million over a period of approximately four years. Assuming 12 producing wells per field, the 141 wells to be drilled would equate to developing 12 fields. The value of \$183.3 million represents the value of labor, materials, equipment, and other supplies that would be consumed to sustain a program of wildcat and production well drilling in Sierra and Otero Counties. In addition, per the RFD, 100 miles of gas transmission pipelines would be constructed, the cost of which is estimated at \$15 million.<sup>2</sup>

For purposes of assessing the regional socioeconomic impacts of the RFD, the IMPLAN input-output modeling system was used (Minnesota IMPLAN Group, Inc. 1999). IMPLAN estimated the secondary (indirect and induced) economic effects of well field development on the basis of projected direct expenses to be incurred in the Planning Area (i.e., Sierra and Otero Counties), and the resulting values were used to project any demographic and other social impacts of oil and gas exploration and development activities. Table 4-6 presents the results of the modeling, displaying the changes in regional total output, value added components, and employment, disaggregated by 1-digit SIC industry sector.

In terms of relative magnitude of impact on the regional economy, the RFD would be less than significant. The direct annual output associated with exploration and development would be

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<sup>1</sup> A "worst-case" scenario is postulated in order to define the maximum extent of socioeconomic impacts that might occur. If only one drilling rig were used, socioeconomic impacts would be spread over approximately six to seven years, as opposed to four years under the two-drilling-rig scenario. This parameter is based on the fact that a typical well takes approximately 21 days to drill, thus limiting the annual output of one drilling rig (under optimal conditions) to 17. (Kerri Sitler, Newfields, Inc., Denver. Personal communication with Robert Mott, November 29, 1999). This analysis assumes that with a total of 141 wells to be drilled, two drilling rigs together drilling a total of 34 wells per year would require about four years to complete the RFD scenario.

<sup>2</sup> Based on a nominal cost of \$15,000 per inch per mile (Personal communication between Eileen Day, Burlington Industries, and Cindy Smith, November 29, 1999) for 10-inch gas transmission pipelines over a total of 100 miles (Personal communication between Kerri Sitler, New Fields, and Robert Mott, April 27, 2000).



approximately \$23.9 million. The additional indirect and induced output resulting from the direct output stimulus would be approximately \$ 6.6 million (a multiplier effect of 1.28). Total output attributable to the exploration and development phase of this project would be over \$30.5 million annually, which represents approximately 1.6 percent of total industry output in the study area.<sup>3</sup>

The number of jobs associated directly with exploration and development would be 275, which would result in an additional 105 indirect and induced jobs. In total, annual average employment would be 381 employees over four years, representing approximately 1.2 percent of total 1997 employment in the Planning Area. The increase in value added in the Planning Area (equivalent to change in gross regional product) would be \$9.4 million (a direct result of exploration and development), resulting in indirect and induced value added of approximately \$3.7 million, for a total of \$13.2 million in value added annually. This would represent less than 1 percent of the Planning Area's total value added/gross regional product. As noted above, Table 4-6 presents an industry sector breakdown of impacts on the Planning Area economy. Note that the indirect and induced impacts are a result of the multiplier effect. The indirect impact component represents the effects of the exploration and development contractors' purchases of goods and services from local vendors. The induced impact component (which is the larger portion of the secondary impacts), is largely manifested in the trade and services sectors, arising from increases in the consumption spending of Planning Area residents who earn income from the project.

In addition to these economic impacts, any removals of grazing land would impact ranchers holding grazing leases. Based on average carrying capacity of lands (in Animal Units [AUs], which vary with the quality of soils and precipitation), estimates of well field leases on ranchers can be developed on a site-specific basis.

Fluid minerals development would cause spillover into local communities in the form of jobs, supply contracts for construction materials and services, sales of retail goods and services to workers, taxes, and any associated requirements for police, fire, health, and welfare services and facilities. Of concern is the capacity of the community to accommodate an influx of non-local workers and business. If it has the capacity, then the area prospers; if not, then some residents may suffer inconveniences or even losses from project-induced pressure on local resources. The construction phase offers the main opportunity for socioeconomic problems to develop, because it contains the bulk of labor force, logistical, and capital spending effects.

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<sup>3</sup> Estimated impacts exclude those impacts that would occur outside Sierra and Otero counties, and expresses dollar amounts in 2000 dollars. The total output was converted to 1997 dollars to estimate the percentage of total study area output.

**TABLE 4-6**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**EXPLORATION AND DEVELOPMENT PHASE**

<b>TOTAL INDUSTRY OUTPUT</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	3,130	15,067	18,197
Mining	0	4,621	2,126	6,747
Construction	23,864,096	54,464	56,072	23,974,632
Manufacturing	0	240,350	45,495	285,845
Transportation and Utilities	0	1,360,962	211,288	1,572,250
Wholesale and Retail Trade	0	454,944	609,016	1,063,960
Finance, Insurance, and Real Estate	0	613,389	523,613	1,137,001
Services	0	1,577,554	689,741	2,267,295
Government	0	57,087	99,955	157,042
<b>Total Impact</b>	<b>23,864,096</b>	<b>4,366,502</b>	<b>2,252,371</b>	<b>30,482,970</b>
<b>TOTAL VALUE ADDED</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	2,426	11,211	13,637
Mining	0	2,997	1,333	4,330
Construction	9,416,122	27,954	26,904	9,470,980
Manufacturing	0	75,491	12,544	88,035
Transportation and Utilities	0	540,513	124,291	664,804
Wholesale and Retail Trade	0	299,139	423,739	722,878
Finance, Insurance, and Real Estate	0	438,516	388,216	826,732
Services	0	939,641	346,223	1,285,864
Government	0	28,249	48,905	77,154
<b>Total Impact</b>	<b>9,416,122</b>	<b>2,354,926</b>	<b>1,383,366</b>	<b>13,154,414</b>

**TABLE 4-6**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**EXPLORATION AND DEVELOPMENT PHASE**

<b>TOTAL LABOR INCOME</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	1,542	6,853	8,395
Mining	0	1,197	426	1,623
Construction	5,108,695	26,341	25,331	5,160,367
Manufacturing	0	59,295	8,701	67,996
Transportation and Utilities	0	338,583	54,324	392,907
Wholesale and Retail Trade	0	180,621	271,704	452,325
Fire, Insurance, and Real Estate	0	120,358	64,225	184,583
Services	0	800,011	295,263	1,095,274
Government	0	19,645	29,673	49,318
<b>Total Impact</b>	<b>5,108,695</b>	<b>1,547,593</b>	<b>756,500</b>	<b>7,412,788</b>
<b>OTHER PROPERTY INCOME</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	797	3,956	4,753
Mining	0	1,595	803	2,398
Construction	3,735,548	1,387	1,346	3,738,281
Manufacturing	0	14,491	3,556	18,047
Transportation and Utilities	0	164,227	55,660	219,887
Wholesale and Retail Trade	0	57,615	71,284	128,899
Finance, Insurance and Real Estate	0	274,798	271,883	546,681
Services	0	110,687	40,947	151,634
Government	0	8,604	19,231	27,835
<b>Total Impact</b>	<b>3,735,548</b>	<b>634,201</b>	<b>468,666</b>	<b>4,838,415</b>

**TABLE 4-6**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**EXPLORATION AND DEVELOPMENT PHASE**

<b>INDIRECT BUSINESS TAXES</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	86	402	488
Mining	0	205	104	309
Construction	571,880	226	227	572,333
Manufacturing	0	1,705	287	1,992
Transportation and Utilities	0	37,703	14,307	52,010
Wholesale and Retail Trade	0	60,903	80,751	141,654
Finance, Insurance, and Real Estate	0	43,360	52,108	95,468
Services	0	28,944	10,012	38,956
Government	0	0	0	0
<b>Total Impact</b>	<b>571,880</b>	<b>173,132</b>	<b>158,198</b>	<b>903,210</b>
<b>EMPLOYMENT</b>	<b>Impact in Number of New Jobs</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	0	0	1
Mining	0	0	0	0
Construction	275	1	1	277
Manufacturing	0	2	0	3
Transportation and Utilities	0	14	2	16
Wholesale and Retail Trade	0	10	18	28
Finance, Insurance, and Real Estate	0	5	3	8
Services	0	32	15	47
Government	0	1	1	2
<b>Total Impact</b>	<b>275</b>	<b>65</b>	<b>40</b>	<b>381</b>

NOTE: Model - Sierra-Otero.iap

The foregoing analysis indicates that the RFD scenario would not likely stress local community resources. This is due in part because the exploration and development activities would be carried on largely by non-local contractors (none are located in either Sierra or Otero Counties), who would bring

in their workers from centers of oilfield activity in the Permian Basin; also, the well sites mostly would be in remote areas, where the contractors would have to provide transient living accommodations for workers, thus isolating the activities. Another factor reducing the local economic stimulus of the exploration and development activities would be the leakage of income due the high proportion of imported (i.e., non-local) exploration and development-related goods and services that would be employed in the wellfield activities.

### Production Phase

Once drilling is completed and production facilities are in place, well field activities are largely low-level. The principal economic benefits of the projects are generated during the operating phase, in the form of fiscal flows to local governments from royalties and taxes on production. In 1997, oil and gas wells on Federal lands in New Mexico generated \$287.9 million in royalties for disbursement to the state and counties. (MMS 1999) This sum was based on production of 14.4 million barrels of oil and 531.4 billion cubic feet of gas, which was about one-half of total gas production on Federal lands that year upon which one-half of the royalties went to the Federal government and one-half to the state and local governments.<sup>1</sup> The average royalty statewide amounted to \$1.534 per barrel (Bbl) of crude oil and \$0.229 per thousand cubic feet (MCF) of natural gas, yielding a total of \$144 million to New Mexico jurisdictions, with the rate accruing to the individual counties ranging upwards of \$0.2 to \$0.25 per MCF.

In order to estimate the economic impacts of these wells with the IMPLAN model, it is necessary first to estimate average levels of production per year and their associated values. The RFD postulates drilling of 30 gas production wells and 60 oil production wells. Assuming in addition that 3 of the wildcat wells and all 12 of the definition wells become successful producers, the RFD would yield a total of 105 producing wells. An analysis of oil and gas production data for the southeastern area of New Mexico indicates that the average producing gas well produces 75,530 MCF dry gas and 595 Bbl of condensates per year (NMBMMR 2000). The average oil well produces 3,107 Bbl of crude per year plus 10,597 MCF of natural gas.<sup>4</sup> (NMBMMR 2000) The IMPLAN model database is as of 1997, so wellhead prices for oil and gas in that year were applied to the production averages to obtain an estimate of the value of new output, value added, and employment that would be associated with the new wells (the results were converted to their year 2000 equivalents for presentation later). According to the New Mexico Bureau of Mines and Mineral Resources, spot wellhead prices for southeast New Mexico crude averaged about \$21 per barrel in 1997, while gas fetched \$1.76 per MCF. Applying these values to the above outputs yields a value of \$83,897 per well per year in crude oil and associated casinghead gas for oil wells. For gas wells, the corresponding value for dry gas and natural

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<sup>4</sup> New Mexico Bureau of Mines and Mineral Resources. Well counts and production data as of 1993 (latest available consolidated statistics). Personal communication with Ron Broadhead by Robert Mott, 27 April 2000.

gas liquids (i.e., condensates) is \$145,421 million per well per year. Multiplying these values by the corresponding numbers of new producing wells (70 oil, 35 gas, respectively)<sup>5</sup>, yields values of annual production for the overall RFD of \$5,872,787 for the oil wells and \$5,089,728 for the gas wells, for a grand total of \$10,962,514 per year. This is the "direct effect" of the RFD upon which the IMPLAN analysis is based.

Using IMPLAN, the indirect and induced annual output that would result from direct output of \$10.96 million (actually \$11.04 million in year 2000 prices) would be approximately \$2.93 million, for a total annual output of approximately \$13.97 million (a multiplier effect of 1.27). Direct annual employment associated with production would be 63 employees. Combined with indirect and induced employment of 36, a total of 99 new jobs would develop as a result of production. In terms of annual value added, direct value added due to the project would be \$6.91 million. Total value added would be \$8.68 million per year, including \$1.77 in indirect and induced impacts to value added. These impacts would represent less than 1.0 percent of total annual economic activity in the study area. Table 4-7 presents the detailed IMPLAN impact analysis results. Again, the multiplier would largely affect the trade and services industry, because the stimulus would originate from increased consumer spending.

**TABLE 4-7**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**PRODUCTION PHASE**

<b>TOTAL INDUSTRY OUTPUT</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	1,574	6,285	7,859
Mining	11,036,740	470,245	887	11,507,872
Construction	0	715,019	23,389	738,408
Manufacturing	0	12,966	18,977	31,943
Transportation and Utilities	0	113,217	88,137	201,354
Wholesale and Retail Trade	0	35,566	254,045	289,611
Finance, Insurance, and Real Estate	0	442,073	218,416	660,490
Services	0	170,148	287,712	457,859
Government	0	33,362	41,695	75,058
<b>Total Impact</b>	<b>11,036,740</b>	<b>1,994,171</b>	<b>939,544</b>	<b>13,970,455</b>

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<sup>5</sup> It was assumed that the 3 successful wildcat wells and the 12 definition wells would be divided between oil and gas production in the same proportion as the development wells (i.e., 10 would be for oil and 5 for gas).

**TABLE 4-7**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**PRODUCTION PHASE**

<b>TOTAL VALUE ADDED</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	1,189	4,677	5,866
Mining	6,911,231	294,472	556	7,206,259
Construction	0	287,981	11,222	299,203
Manufacturing	0	4,585	5,233	9,817
Transportation and Utilities	0	56,963	51,848	108,810
Wholesale and Retail Trade	0	23,526	176,760	200,286
Finance, Insurance, and Real Estate	0	312,543	161,937	474,479
Services	0	93,755	144,423	238,178
Government	0	15,027	20,400	35,427
<b>Total Impact</b>	<b>6,911,231</b>	<b>1,090,040</b>	<b>577,055</b>	<b>8,578,325</b>
<b>TOTAL LABOR INCOME</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	883	2,859	3,742
Mining	2,195,367	93,547	178	2,289,092
Construction	0	167,431	10,566	177,997
Manufacturing	0	3,531	3,630	7,160
Transportation and Utilities	0	26,034	22,661	48,695
Wholesale and Retail Trade	0	14,451	113,339	127,790
Finance, Insurance, and Real Estate	0	51,584	26,792	78,376
Services	0	78,426	123,166	201,593
Government	0	8,875	12,378	21,253
<b>Total Impact</b>	<b>2,195,367</b>	<b>444,762</b>	<b>315,568</b>	<b>2,955,698</b>

**TABLE 4-7**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**PRODUCTION PHASE**

<b>OTHER PROPERTY INCOME</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	262	1,650	1,912
Mining	4,176,547	177,947	335	4,354,828
Construction	0	104,531	562	105,092
Manufacturing	0	959	1,483	2,442
Transportation and Utilities	0	24,351	23,219	47,569
Wholesale and Retail Trade	0	4,384	29,736	34,119
Finance, Insurance, and Real Estate	0	210,336	113,409	323,745
Services	0	12,175	17,080	29,255
Government	0	6,152	8,022	14,174
<b>Total Impact</b>	<b>4,176,547</b>	<b>541,095</b>	<b>195,496</b>	<b>4,913,13</b>
<b>INDIRECT BUSINESS TAXES</b>	<b>Impact in Millions of Year 2000 Dollars</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	43	168	211
Mining	539,318	22,978	43	562,339
Construction	0	16,020	95	16,114
Manufacturing	0	95	120	215
Transportation and Utilities	0	6,578	5,968	12,546
Wholesale and Retail Trade	0	4,691	33,685	38,376
Finance, Insurance, and Real Estate	0	50,623	21,735	72,358
Services	0	3,154	4,176	7,330
Government	0	0	0	0
<b>Total Impact</b>	<b>539,318</b>	<b>104,182</b>	<b>65,990</b>	<b>709,490</b>



**TABLE 4-7**  
**OIL AND GAS EXPLORATION AND PRODUCTION IMPACT ANALYSIS**  
**PRODUCTION PHASE**

<b>EMPLOYMENT</b>	<b>Impact in Number of New Jobs</b>			
<b>Sector</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
Agriculture	0	0	0	0
Mining	63	3	0	65
Construction	0	8	0	9
Manufacturing	0	0	0	0
Transportation and Utilities	0	1	1	2
Wholesale and Retail Trade	0	1	8	8
Finance, Insurance, and Real Estate	0	3	1	5
Services	0	3	6	9
Government	0	0	0	1
<b>Total Impact</b>	<b>63</b>	<b>20</b>	<b>17</b>	<b>99</b>

NOTE: Model - Sierra-Otero.iap

Assuming average royalty rates of \$1.534 per Bbl of crude oil and \$0.25 per MCF on gas production from leases in Sierra and Otero Counties and the nominal production rates cited above, the royalties that would accrue to the State would amount to approximately \$1.21 million per year.<sup>2</sup> These royalties would be in addition to the Federal government's ongoing payments in-lieu of taxes (PILT) that have been paid to local governments as compensation for the exemption of Federal lands from local property taxes (costs of which as well as other administrative and management expenses the Federal government recovers from bonuses, rents, and royalties on leases of mineral and grazing rights).

#### Abandonment Phase

When it comes time to abandon production facilities, impacts are also relatively benign, because the manpower and equipment required for capping and plugging wells and removing other facilities is small.

## 4.3 ALTERNATIVES

The following sections provide descriptions of the potential impacts that could result from fluid minerals activities as a result of continuing existing management (No-action Alternative) or implementing the alternatives to existing management (Alternatives A or B).

The discussion of each alternative begins with a table summarizing the constraints that would be imposed under each alternative. The discussions for each alternative focus on specific resource concerns.

Potential impacts on the various resources from oil and gas activities are addressed in Section 4.3.1. To facilitate the discussion and narrow the focus geographically, the Planning Area was divided into four geographic areas. These areas generally correspond to the hydrologic basins shown on Map 3-6 including the Salt/Pecos River Basins, Tularosa Basin, Jornada del Muerto Basin, and Rio Grande/Mimbres/Gila River Basins. It was assumed for the purpose of this programmatic analysis that the RFD could occur generally anywhere on Decision Area lands that are open to leasing within each basin. For other resources, it was not appropriate or necessary to discuss the resource by basin but, rather, a general discussion for the alternative was deemed sufficient.

Potential impacts on the various resources from geothermal activities are addressed in Sections 4.3.2. The discussion of geothermal resources focuses geographically on the area where the potential for developing geothermal resources is high and open for leasing; that is, the Rio Grande/Mimbres/Gila River Basins.

### 4.3.1 Oil and Gas Resources

#### **No-action Alternative (Existing Management)**

As explained previously (Chapter 2), under the No-action Alternative, fluid minerals leasing and development would continue under existing management direction. Overall, a substantial amount of land open to leasing could be leased with standard lease terms and conditions. However, potential impacts would have to be identified on a case-by-case basis at the time of an APD and measures to mitigate impacts would have to be determined and applied as conditions of approval.

Table 4-8 summarizes the approximate acres by basin area of surface lands that are closed to leasing or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres within each basin area and acres overlying Federal fluid minerals.

## Lands and Access

*Salt/Pecos River Basin* Under existing management direction, a total of approximately 50,581 acres (about 7 percent) of BLM's Decision Area within this basin area is currently closed to leasing. Approximately 38,372 acres (5 percent) are nondiscretionarily closed to leasing to protect resources in the Brokeoff Mountains WSA and prohibit activities in the impact area of a former Air Force bombing and gunnery range. Approximately 12,209 acres (2 percent) are discretionarily closed to leasing to protect resources in the Alkali Flats, Cornudas Mountain, Wind Mountain, and Alamo Mountain ACECs. The majority of BLM's Decision Area (695,339 acres, or 93 percent) is open to leasing with standard lease terms and conditions, and 662 acres (less than 1 percent) is open to leasing with controlled surface use (Butterfield Trail). Also, there are areas associated with the WSAs, ACECs, and three watershed activity areas where travel is limited to existing roads and trails year-round.

**TABLE 4-8**  
**NO-ACTION ALTERNATIVE**  
**CONSTRAINTS IN DECISION AREA BY BASIN**  
**(approximate acres)**

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/Mimbres/Gila River
<b>Closed to Leasing</b>				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	12,209	5,465	0	0
<b>Open to Leasing</b>				
No surface occupancy	0	1,181	40	3,060
Controlled surface use and timing limitation	0	0	0	0
Controlled surface use	662	0	1,561	691
Timing limitation	0	0	231,288	5,300
Standard lease terms and conditions	695,339	302,074	40,693	703,395
Total acres	746,582	310,132	277,915	718,377
Total acres overlying Federal minerals	745,272	309,135	277,691	714,190

Considering the small percentage of Decision Area lands closed to leasing (7 percent) or constrained with stipulations for controlled surface use (less than 1 percent) and the area of surface disturbance projected for the RFD is less than 1 percent (6,589 acres short term, 862 acres long term), overall impacts on Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

*Tularosa Basin* A total of approximately 6,877 acres (about 2 percent) of BLM's Decision Area within this basin area is closed to leasing to protect the resources in the Sacramento Escarpment ACEC. The majority of the Decision Area (302,074 acres, or 97 percent) is open to leasing with

standard lease terms and conditions, and 1,181 acres (less than 1 percent) is open to leasing with no surface occupancy to protect resources of the Rattlesnake Hill Archaeological District, Danley Ecological Study Plot, and along portions of the Tularosa River. Also, there are areas associated with the ACEC and two watershed activity areas where travel is limited to existing roads and trails year-round.

Considering the small percentage of BLM's Decision Area that is closed to leasing (7 percent) and constrained with a stipulation for no surface occupancy (less than 1 percent) and the area of surface disturbance projected for the RFD would be 2 percent, overall impacts on the Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

*Jornada del Muerto Basin* A total of 4,333 acres (1.5 percent) of BLM's Decision Area within this basin area is nondiscretionarily closed to leasing to protect resources of the Jornada del Muerto WSA. Forty acres are open to leasing with no surface occupancy to protect the Caballo Mountain Communication Site. The majority of the Decision Area (231,288 acres, or 83 percent) is open to leasing with a stipulation for a timing limitation required by the military in the area of the White Sands Missile Range Safety Evacuation Zone. Approximately 1,561 acres (less than 1 percent) is open to leasing with controlled surface use (portion of the Jornada del Muerto Trail), and 40,693 (15 percent) is open to leasing with standards terms and conditions.

Considering the small percentage of BLM's Decision Area that is closed to leasing and is constrained with no surface occupancy (1.2 percent) and the surface disturbance from the RFD would be 2 percent, overall impacts on the Decision Area from fluid mineral activities are expected to be minimal. However, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone (83 percent of the Decision Area), which is within an area with a medium potential for oil and gas resources, may have an effect on industry's decisions regarding leasing and development.

*Rio Grande/Mimbres/Gila River Basins* A total of 1,931 acres (less than 1 percent) of BLM's Decision Area within this basin is closed to leasing. Approximately 3,060 acres (less than 1 percent) are open to leasing with a stipulation for no surface occupancy to protect the Caballo Mountain Communication Site, and Trujillo, Cuchillo, and Nordstrom Ecological Study Plots. The majority of the Decision Area (707,395 acres, or about 99 percent) is open to leasing with standard lease terms and conditions. Approximately 691 acres (less than 1 percent) are open to leasing with controlled surface use and 5,300 acres, or less than 1 percent, with a stipulations for timing limitations.

Considering that the majority of the Decision Area is open with standard lease terms and conditions (98 percent) and a small percentage of BLM's Decision Area constrained with stipulations (less than 1 percent) and the area of surface disturbance projected for the RFD would be less than 1 percent,

overall impacts on Decision Area land or on the ability to explore for or exploit oil and gas resources are expected to be minimal.

## Minerals

In general, under existing management, surface and subsurface management within the Planning Area has the potential to affect the ability to explore for or exploit oil and gas resources.

*Salt/Pecos River Basins* This geographic area is highly prospective for oil and gas resources. Approximately 35 percent of the entire basin area is estimated to have a medium potential for oil and gas resources and there was a highly favorable gas show in 1997 (Bennett Ranch Unit discovery well). Approximately 99 percent of the basin area overlies Federal fluid minerals. Much of BLM's Decision Area has a medium potential for oil and gas resources (refer to Map 3-3). Since only a small percentage of the Decision Area is closed to leasing or constrained with restrictions, there would be little effect on the ability to explore for or exploit oil and gas resources.

*Tularosa Basin* This area also is prospective for oil and gas with 74 percent of the entire basin estimated to have a medium potential for oil and gas resources. Good gas shows were seen in two wells in 1976 and 1990 in the northern portion of the basin. More than 99 percent of the basin overlies Federal fluid minerals. However, 85 percent of the Federal fluid minerals for which BLM has some and/or all surface jurisdiction is closed to leasing and is not part of the Decision Area. Since the majority of land within BLM's Decision Area could be leased and managed with standard lease terms and conditions, there would be little effect on the ability to explore for or exploit oil and gas resources.

*Jornada del Muerto Basin* This area also is prospective for oil and gas with 79 percent of the entire basin estimated to have a medium potential for oil and gas resources. Ninety-nine percent of the basin overlies Federal fluid minerals. A small percentage of BLM's Decision Area is closed to leasing or open to leasing with stipulations for controlled surface use, and 15 percent is open to leasing with standards terms and conditions. However, 83 percent of BLM's Decision Area is open to leasing with a timing limitation, required by the military, to evacuate the White Sands Safety Evacuation Zone on days when missiles are fired. Although this area is open to leasing, this stipulation may effect decisions to lease and develop in this area.

*Rio Grande/Mimbres/Gila River Basins* This area also is prospective for oil and gas with 36 percent of the entire area estimated to have a medium potential for oil and gas resources, almost exclusively in the Rio Grande Basin. An excellent gas show was seen in one well in 1953 in the northern portion of the basin (subsurface Engle Basin). More than 99 percent of the entire basin area overlies Federal

minerals. Less than 1 percent of the public lands in the basins is closed to leasing. Of the public lands open to leasing, most (about 99 percent) are managed with standard lease terms and conditions. There would be little effect on the ability to explore for or exploit oil and gas resources.

## Soils

*Salt/Pecos River Basin* Within this basin area, highly erosive and fragile soils are found west of the Brokeoff Mountains in an area that is open to leasing with standard lease terms and conditions; however, the area is estimated to have a low potential for oil and gas resources. Three watershed activity areas are located in this basin area: Moccasin and Otto Draw, Wind and Chess Draw, and a watershed east of Crow Flats. These areas are open with standard lease terms and conditions; however, travel within these watershed areas is limited to existing roads and trails. Known and potential prime farmlands are located in the Decision Area; however, if the entire RFD were to occur in an area of prime farmland, less than 1 percent of the prime farmland would be affected and would be reclaimed as wells are abandoned. Impacts on highly erosive and fragile soils and prime farmland are not anticipated to be significant.

*Tularosa Basin* Although the majority of the highly erosive soils and known and potential prime farmland occurs within areas closed to leasing and outside of BLM's Decision Area, there are highly erosive and fragile soils located within BLM's Decision Area, mostly north of Alamogordo and known and potential prime farmland located south of Alamogordo. Two watershed activity areas occur in this basin: Three Rivers Watershed and a watershed east of Tularosa and south of Tularosa River. Under existing management, these watershed areas are open to leasing; however, travel within them is limited to existing roads and trails. Assuming that best management practices would be implemented and reclamation were successful, impacts on soils and prime farmlands would be minimal.

*Jornada del Muerto Basin* No highly erosive and fragile soils were identified in BLM's Decision Area within this basin. Known and potential prime farmlands are located in the southern portion of the basin in an area estimated to have a medium potential for oil and gas resources. The area of known and potential prime farmlands is open to leasing with standard lease terms and conditions; however, the majority of these known and potential prime farmlands overlap with the White Sands Safety Evacuation Zone, which has a timing limitation restriction on use of the area. Assuming that best management practices and (if needed) site-specific mitigation measures would be implemented and reclamation were successful, impacts on known and potential prime farmland would be minimal.

*Rio Grande/Mimbres/Gila River Basins* Highly erosive and fragile soils are located primarily along the Rio Grande and the drainages emanating from the west and into the Rio Grande. Known and potential prime farmlands occur in association with these soils. Other smaller areas of concern occur to the east

of the Rio Grande. The area west of the river is estimated to have a medium potential for oil and gas resources. The majority of BLM's Decision Area in this basin area is managed as open to leasing with standard terms and conditions. Assuming that site-specific mitigation measures would be implemented and reclamation were successful, impacts on soils and known and potential prime farmlands would be minimal.

## Water Resources

### Groundwater

*Salt/Pecos River Basins* This area is underlain by an undeclared groundwater basin. Groundwater is found mostly in consolidated rock with total dissolved solids (TDS) typically between 1,000 and 3,000 parts per million (ppm). While in all parts of the Planning Area a water supply well typically can be drilled without requiring an operator to receive a water allotment, in an undeclared basin the operator does not have to apply for a permit. The permit application allows the State Engineer's office (SEO) to review the water requirements to ensure that no existing water right is permanently impaired. Without this review, the water supply may be impacted. Depressed water levels were reported as early as the 1950s with the concern that increased depletion of the water reserves would decrease water quality (BLM 1999). The annual recharge of the basin is estimated to be less than 100,000 acre-feet, which is still much greater than the 12.24 acre-feet/year estimated for the period of greatest development under the RFD (24 wells drilled/year at 0.51 acre-feet per well). Therefore, the impact on groundwater resources are expected to be minimal.

*Tularosa Basin* The area is underlain by high TDS groundwater (typically greater than 3,000 ppm) found in basin fill deposits. Fresher waters (less than 3,000 ppm), which can be used for stock or potentially domestic uses, can be found in the deep consolidated aquifers of the Otero Platform, Sacramento, and San Andres Mountains and typically are not underlain by Federal minerals. Most of the basin with Federal fluid mineral rights is closed to leasing due primarily to military lands (White Sands Missile Range and McGregor Range) and on lands open for leasing the groundwater TDS concentrations are high. Estimated annual recharge for the basin is only 5,000 acre-feet/year. While high TDS water may indicate that the water likely would not be degraded by project activities, the water probably would not be of sufficient quality to be used for drilling makeup water. Impacts on groundwater resources are expected to be minimal.

*Jornada del Muerto Basin* Groundwater in this basin typically is shallow (less than 500 feet) with TDS concentrations between 1,000 to 3,000 ppm. This basin is considered a "closed basin;" what flows in does not flow out. Therefore, water quality could be highly susceptible to contamination. Annual recharge of the basin has not been estimated but occurs mainly by infiltration from flash floods in the

arroyos. As the largest annual water need is only 12.24 acre-feet, the impact on the water supply is not expected to be significant. The closed nature of the basin with its relatively fresh water could be impacted by contamination, the extent of which would not be expected to be great; therefore, impacts on groundwater resources are expected to be minimal.

*Rio Grande/Mimbres/Gila River Basins* Groundwater in this portion of Sierra County typically is shallow and of good quality (less than 3,000 ppm TDS). Water quality is slightly better in the Palamos Basin (typically less than 1,000 ppm TDS) than in the Engle Basin (typically less than 3,000 ppm TDS). Recharge is from flash floods in the mountain arroyos as well as infiltration from the Rio Grande and its associated reservoirs. The impacts on groundwater resources are expected to be minimal.

## Surface Water

*Salt/Pecos River Basins* Although the area of disturbance projected during development in the RFD (for development) is relatively minor compared to the total area of the Salt/Pecos River Basin, those areas where perennial flow occurs are subject to the greatest potential impacts. The upper Sacramento River and the headwaters of the Rio Penasco represent the only perennial flow of consequence within this basin area. Piñon Creek drains the northern Salt Basin and terminates in Crow Flats. Scott Able Creek is a short stretch of perennial flow that joins the Sacramento River near its headwaters (BLM 1985).

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, the operator would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Additionally, the Wind and Chess Draw watershed area, Moccasin and Otto Draw watershed area, and the watershed east of Crow Flats already are protected partially through the limitation on travel to use of existing roads and trails. Based on protection of surface waters as provided by existing management direction, it is expected that impacts within the Salt/Pecos River Basins are expected to be minimal.

*Tularosa Basin* Areas of specific concern within the Tularosa Basin include all areas where perennial flow occurs. Within the Tularosa Basin perennial streamflow occurs in the upper reaches of Three Rivers although the most important stream is Tularosa Creek. Springs in the head canyons and tributaries in the northern Sacramento Mountains contribute to the flow of Tularosa Creek. Perennial flow occurs in the upper Three Rivers Canyon and in Indian Creek. La Luz Creek also is perennial, fed by springs along La Luz and Fresnal Canyons and tributaries north of Alamogordo. Alamo Creek flows to the Tularosa Basin from the Sacramento Mountains and Salt Creek drains the Malpais and the San Andres Mountains. The basin is intermontane and also contains many playas such as Lake Lucero.



Areas sensitive to additional degradation in water quality include perennial portions of Three Rivers from U.S. Highway 54 to the White Mountain Wilderness boundary, designated as “not supported” due to high conductivity and temperature probably from agriculture, and the Tularosa Creek from the town of Tularosa to the headwaters, designated as “partially supported” although the specific pollutant or threat is unknown.

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, the operator would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Additionally, the Three Rivers watershed and the watershed east of Tularosa and south of the Tularosa River already are protected partially by limiting travel to existing roads and trails. Based on protection of surface waters as provided by existing management direction, impacts within the Tularosa River Basin are expected to be minimal.

*Jornada del Muerto Basin* The Jornada del Muerto Basin contains all surface water flows within its boundaries. Although there are no perennial streams in the basin, it does contain many playas fed by stormwater runoff during the rainy season. Springs occur in the surrounding mountains but most yield only small quantities of unpotable water (Weir 1965).

Activities more likely to occur during the rainy season have the greatest potential to impact surface water quality or quantity within the Jornada del Muerto Basin. Potential direct impacts on surface waters include soil erosion and resulting runoff and sedimentation into receiving surface waters, as well as accidental releases of contaminants.

Based on protection of surface waters as provided by existing management direction and the lack of perennial flows, impacts on surface waters within the Jornada del Muerto Basin are expected to be minimal.

*Rio Grande/Mimbres/Gila River Basins* Those areas of specific concern within the Rio Grande/Mimbres/Gila River Basins include all areas where perennial flow occurs. In addition to the Rio Grande, a few perennial streams occur in the mountains, but in general the area is drained by ephemeral channels. The primary drainages to the Rio Grande emanate from the west and include Alamosa Creek, Cuchillo Negro Creek, Las Palomas Creek, Las Animas Creek, Seco Creek, and Percha Creek. Elephant Butte and Caballo Reservoirs (not in BLM’s Decision Area) are maintained primarily to store irrigation water although the Elephant Butte Reservoir has a secondary function as a hydroelectric power producer.

In general, to minimize impacts on wetlands associated with perennial streamflow and on playas, operators would comply with Section 404 of the Clean Water Act and adhere to BLM guidelines. Based on protection of surface waters as provided by existing management direction, impacts within the Rio Grande/Mimbres/Gila River basins are expected to be minimal.

## Vegetation

*Salt/Pecos Basin* Vegetation types that are considered to be more sensitive because of forage production or revegetation include grasslands, woodland/forest, montane scrub, playas, and arroyos. Within BLM's Decision Area, grasslands constitute about 33 percent (249,530 acres) and within that are the remnant desert grasslands in the Otero Mesa area. Woodland/forest vegetation constitutes 9 percent (69,987 acres). Montane scrub, a minor component, occurs on 2 percent of the Decision Area. Playas occur on 3,152 acres and arroyos were identified on 45 acres, which combined to total less than 1 percent. No riparian or wetland areas were delineated within the Decision Area in this basin; however, if such areas were identified at the time of an APD, they would be protected under Section 404 of the Clean Water Act.

*Tularosa Basin* Grassland vegetation constitutes 32 percent (100,412 acres) of the Decision Area within this basin. Woodland/forest occurs on 4 percent of the area. Montane scrub occurs on 2.5 percent of the area (7,780 acres). Twenty-seven acres of playas are mapped. Riparian vegetation and wetlands occur for short stretches along Tularosa Creek, along the drainage systems north of Tularosa and again north of La Luz. These areas are managed as open to leasing, but no surface occupancy is allowed, which restricts development within 0.25 mile (400 meters) of these areas. This basin contains a number of noxious weed species. Areas cleared of vegetation often facilitate the spread of these plants, and measures should be taken to avoid their spreading.

*Jornada del Muerto Basin* The majority of BLM's Decision Area within this basin is desert scrub vegetation. Grasslands constitute 13 percent of the area, woodland/forest constitutes 1 percent, and arroyos comprise less than 1 percent. Playas are delineated on only 57 acres.

*Rio Grande/Mimbres/Gila River Basins* The Decision Area within this basin is characterized by desert scrub vegetation, but also contains large areas of grasslands (198,702 acres, or 28 percent). Woodland/forest vegetation occurs on approximately 5 percent (33,393 acres). Arroyos and playas are relatively abundant, occurring on 18,988 acres (3 percent), and 115 acres, respectively. Arroyos and playas should be avoided by ground-disturbing activities.

## Wildlife

Generally, under existing management, BLM's Decision Area is managed as open to leasing with standard lease terms and conditions. If impacts on important wildlife resources (e.g., riparian and arroyo habitats, birthing and nesting areas) are identified during site-specific investigations at the time of an APD, standard lease terms and conditions allow for relocating the site of a proposed facility within a reasonable distance (e.g., as much as or more than 200 meters). This may not be adequate for the avoidance of such resources in all cases. Standard lease terms and conditions also allow for delaying

activities within a reasonable time period (e.g., as much as or more than 60 days). This would be useful if nest sites or birthing areas are identified, although birthing and nesting periods are often longer than 60 days for big game and raptor species, respectively.

Standard lease terms and conditions would not necessarily allow the BLM to mitigate all impacts on fish and wildlife habitat. Detrimental effects that could occur under existing management include (1) disturbance of birthing areas that may be identified, (2) new road construction into isolated or unroaded areas, (3) disturbance to nesting raptors and waterfowl, and (4) impacts on aquatic/riparian/arroyo habitats.

Standard lease terms and conditions do not require the use of existing roads; however, use of the existing road system is encouraged to the extent practical. The worst-case scenario would be that all roads be upgraded or constructed new resulting in greater disturbance. Fragmentation resulting from those roads would depend on the location of the roads. Mitigation measures are not required and, therefore, impacts of the proposed development would not be reduced.

*Salt/Pecos River Basins* An important big game habitat that exists in this area is the Otero Mesa Habitat Management Area, which coincides with an area of remnant desert grasslands—one of the largest contiguous grasslands left in the region. This area is important habitat for pronghorn. Loss of grasslands due to clearing for pads and roads would lead to fragmentation of habitat. Fragmentation and increased road access in this area could have detrimental effects on pronghorn populations. Also, the terrain of Otero Mesa is relatively level. Therefore, placement of wells and roads would be visible for long distances and there would be little opportunity for visual and auditory barriers between the herd and any field development. Small mammals and birds associated with grasslands would either avoid the areas during fluid minerals activities or be displaced or killed. Existing management direction would not allow for these potential impacts to be mitigated completely. If a substantial amount of development were to occur in this area, impacts could be significant. A worst-case scenario would exist if the three field developments, described as part of the RFD, occurred in the desert grassland habitat area.

Only about 45 acres of arroyo habitat are mapped within this basin area (a larger amount of unmapped arroyo habitat is present). Loss of these habitats would have adverse effects on small birds, reptiles, amphibians, and mammals that inhabit the denser vegetation found along these drainages.

Riparian/wetlands/playas occur within the Alkalai Flats ACEC, which is closed to leasing. Any other riparian (or wetland) habitats identified in this area would be avoided in compliance with Section 404 of the Clean Water Act and BLM guidelines. Springs or other water sources should be identified and avoided.

*Tularosa Basin* Mule deer and elk are present throughout the Sacramento Mountains and pronghorn inhabit the valley west of the Sacramento Mountains and north of the Jarilla Mountains. The pronghorn habitat is more isolated, and exploration and development activities in this area could displace the

animals into less desirable habitat. Standard lease terms and conditions would not be effective in mitigating disturbance in this area. Elk inhabit the higher elevations of the Sacramento Mountains. Most of this basin area has been estimated as having a medium potential for oil and gas resources; however, elk in this area could move to adjacent habitat during periods of disturbance associated with oil and gas activities.

Portions of lands along the Tularosa River are managed as open to leasing, but no surface occupancy is allowed. Although the justification for this is to protect recreational opportunities, fish and wildlife benefit as well. Sensitive riparian or wetland areas are expected to be small and could be avoided by ground-disturbing activities in compliance with Section 404 of the Clean Water Act.

*Jornada del Muerto Basin* Woodland/forest habitat type is located in the San Andres Mountains. The environment of this basin supports pronghorn, and mule deer inhabit the San Andres Mountains. If fluid mineral exploration and development occur within the grassland or woodland habitat types, a short-term loss of habitat for big game would result. Road construction in this area could fragment currently contiguous patches of woodland, which would affect big game, raptors, and other bird species residing there. Nest sites could be lost and active nests near development could be abandoned. Much of this area is managed for other resources as open to leasing with controlled surface use, which may benefit wildlife depending on the location of facilities. The arroyo habitat type is located along drainages on the eastern slope of the Caballo Mountains and should be avoided. Sensitive riparian or wetland areas that may be in the basin are expected to be small and could be avoided.

*Rio Grande/Mimbres/Gila River Basins* Wildlife habitat within this area supports elk, deer, and pronghorn. Deer and elk inhabit the eastern slope of the Black Range and Mimbres Mountains, with deer habitat extending eastward into the valley. The Caballo Mountains deer habitat area has the specific objective of providing adequate habitat for mule deer. The southeastern corner of this area includes a small portion of antelope habitat located within the Jornada del Muerto. Areas within the Caballo Mountains have been identified as potential reintroduction sites for bighorn sheep.

A worst-case scenario would exist if the three field developments, described as part of the RFD, occurred within habitat identified for a given herd in the Caballo Mountains. If the field developments were to be placed in the area of individual herds or habitat areas, this could result in disturbance to big game during construction. The presence of wells and roads could result in habitat fragmentation especially if travel routes are blocked. New road construction could result in the loss of escape cover and result in the increased loss of animals through legal and illegal hunting. The use of existing roads where possible would reduce the need for new roads. Increased traffic along these roads would increase the potential for direct and indirect effects on wildlife. Loss of woodland habitat would

displace many species of birds and other wildlife. Loss of grasslands would reduce populations of small mammals, which provide a prey base for raptors.

Arroyo habitats in this basin area are important movement corridors for wildlife and support many other animal species, including birds and small mammals. There are numerous arroyos covering approximately 18,988 acres, within this basin area, located primarily west of the Caballo Mountains and draining into the Rio Grande and associated reservoirs. The siting of the field developments along adjacent arroyos could disrupt wildlife movement and result in the loss of habitat for birds and small mammals.

### Special Status Species

Under existing management, the majority of BLM's Decision Area is managed as open to leasing with standard lease terms and conditions, which allow for relocating the site of a proposed facility within a distance of 200 meters and/or for a period of up to 60 days if needed to avoid a sensitive resource. This would offer limited protection to active nest sites and birthing areas. However, standard lease terms and conditions offer no specific protective measures for special status species. Potential impacts on special status species would be identified through a case-by-case analysis at the time of an APD for each site and prudent operation measures would have to be developed as conditions of approval and attached to the APD.

The following sections list special status species likely to occur within each of the basins. The discussion of potential effects is provided in the section titled "Impacts Common to All Alternatives."

*Salt/Pecos River Basins* Special status species potentially occurring within BLM's Decision Area of this area include Guadalupe rabbitbrush, Guadalupe Mountains mescal bean, fish hook barrel cactus, gray sibara, grama grass cactus, Kuenzler hedgehog cactus, Todsen's pennyroyal, Glass Mountain coral root, gypsum blazing star, gypsum ringstem, aplomado falcon, peregrine falcon, Arizona black-tailed prairie dog, mountain plover, Baird's sparrow, loggerhead shrike, ferruginous hawk, western burrowing owl, gray-footed chipmunk, Mexican spotted owl, northern goshawk, Sacramento prickly poppy, southwestern willow flycatcher, bald eagle, ferruginous hawk, yellow-billed cuckoo, desert bighorn sheep, Guadalupe southern pocket gopher, Cornudas Mountain land snail, Texas horned lizard, and numerous bat species.

*Tularosa Basin* Special status species potentially occurring within BLM's Decision Area in this basin include Sacramento prickly poppy, grama grass cactus, Todsen's pennyroyal, Wright's marsh thistle, Alamo beardtongue, aplomado falcon, peregrine falcon, ferruginous hawk, Mexican spotted owl, Baird's sparrow, loggerhead shrike, white faced ibis, black tern, least tern, Arizona black-tailed prairie dog, desert bighorn sheep, southwestern willow flycatcher, yellow-billed cuckoo, White Sands woodrat, desert pocket gopher, Texas horned lizard, and numerous bat species.

*Jornada del Muerto Basin* Special status species potentially occurring within BLM's Decision Area of this basin include grama grass cactus, aplomado falcon, loggerhead shrike, bighorn sheep, Texas horned lizard, and numerous bat species.

*Rio Grande/Mimbres/Gila River Basins* Special status species potentially occurring within BLM's Decision Area of this basin include Sheer's cory cactus, Duncan's cory cactus, Roetter's hedgehog cactus, bald eagle, southwestern willow flycatcher, yellow-billed cuckoo, loggerhead shrike, Neotropic cormorant, New Mexican jumping mouse, Chiricahua leopard frog, Arizona southwestern toad, longfin dace, Mineral Creek mountain snail, Texas horned lizard, and numerous bat species.

### Rangeland

Under existing management, grazing areas are managed generally as open to leasing with standard lease terms and conditions and the number of livestock that are allowed within a particular allotment has been established by the BLM. Under standard lease terms and conditions, for geophysical exploration, range improvements would not be disturbed or altered without prior authorization. Road and pipeline construction generally cause the most losses to grazing from surface clearing of vegetation. Overall, impacts on grazing are expected to be minimal throughout the Decision Area. Local or site-specific concerns or potential concentration of impacts in one area may require additional consideration as part of the APD approval process.

### Cultural Resources

In general, regardless of the alternative, potential impacts on cultural resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures would be expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects. Cultural resources of particular concern are addressed by basin below.

*Salt/Pecos Basins* Existing management provides specific protection for two ACECs defined specifically to protect cultural resources (Cornudas Mountain, and Alamo Mountain) and a fourth (Wind Mountain) also protects some archaeological sites. The ACECs are closed to leasing. In additions, surface use is controlled within 0.25 mile (400 meters) of the well-preserved segment of the Butterfield Trail to protect physical remnants of this historic route.

*Tularosa Basin* The Three Rivers ACEC, defined to specifically protect the Three Rivers Petroglyph Site, is closed to leasing. Rattlesnake Hill Archaeological District is managed as open to leasing with a restriction of no surface occupancy. Two other areas important for cultural resources, Lone Butte and Jarilla Mountains, are managed as open to leasing with standard lease terms and conditions. However, ORV use is limited to existing roads and trails in the Lone Butte area and the Jarilla Mountains areas is closed to ORV use.

*Jornado del Muerto Basin* Surface use is controlled within 0.25 mile (400 meters) of the well-preserved segments of the Jornada del Muerto Trail to protect physical remnants of this historic route.

*Rio Grande/Mimbres/Gila River Basins* A portion of the Jornada del Muerto Trail is located in this basin area as well. As explained above, surface use is controlled within 0.25 mile (400 meters) of the well-preserved segments of the trail to protect physical remnants of this historic route. Another important cultural resource is the Lake Valley historic townsite, which under existing management is managed as open to leasing with standard lease terms and conditions. However, protection of this site is through existing cultural resource regulations.

## Recreation

Under existing management, recreation resources generally are managed as open to leasing with standard lease terms and conditions, with the exception of sections of the Tularosa River where no surface occupancy is permitted. Areas that are closed to or limit ORV use are under standard lease terms and conditions, with the exceptions of ACECs and WSAs that have been closed to leasing. There is some potential conflict between development activities and the primitive recreation opportunities provided in areas where ORV use is prohibited or limited.

*Salt/Pecos River Basins* Brokeoff Mountains WSA and four ACECs are closed to leasing. No area within this basin is currently closed to ORV use, but vehicles are limited to existing roads and trails on approximately 65,583 acres. These areas are located near the Cornudas Mountains, Brokeoff Mountains, and Moccasin and Otto Draw Watershed Area. The Cornudas and Brokeoff Mountains are in an area estimated as having a medium potential for oil and gas resources.

*Tularosa Basin* Areas along Tularosa River (approximately 119 acres) are managed as open to leasing but no surface occupancy is allowed in order to protect recreational opportunities. The Red Sands ORV Area, an important recreation resource, is currently managed as open to leasing with standard lease terms and conditions. Approximately 885 acres including and in proximity to the Rattlesnake Hill Archaeological District are closed to ORV use to protect cultural resources. On an additional 35,304 acres, ORV use is limited to existing roads and trails. These sensitive areas are estimated to have a medium potential for oil and gas resources.

*Jornada del Muerto Basin* No area has been designated as closed or limited to ORV use in this basin. The majority of this area has a medium potential for oil and gas resources.

*Rio Grande/Mimbres/Gila River Basins* No area within this basin is currently closed to ORV use, but vehicles are limited to existing roads and trails on 6,222 acres. The area of limited ORV use is identified as having low potential for oil and gas resources.

### Visual Resources

Areas designated as VRM Class I, are closed to leasing under the No-action Alternative; therefore, no visual impacts from fluid minerals activities would occur in these locations. Under existing management, VRM Classes II through IV are managed with standard lease terms and conditions, under which development of the RFD has the potential to result in significant visual impacts in other locations within BLM's Decision Area. Oil and gas development likely would result in contrast of line, form, color, and texture to the characteristic landscape and would attract attention depending upon the location and proximity to sensitive viewers.

*Salt/Pecos River Basins* Within this basin area, approximately 5,850 acres are designated as VRM Class I, all of which is closed to leasing. These VRM Class I areas include the Cornudas Mountains, Wind Mountain, and Alamo Mountain ACECs.

VRM Class II areas within BLM's Decision Area portion of this basin constitute 103,001 acres including portions of the Brokeoff Mountains, Brokeoff Mountains WSA, and land surrounding the town of Piñon. The RFD could be widely distributed throughout BLM's Decision Area or it could be concentrated within designated VRM Class II areas open to leasing within the basin area. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class II should follow the basic elements in the characteristic landscape, and contrast resulting from this development must not attract attention. Under existing management, oil and gas development projected for the RFD likely would not meet the BLM VRM objectives and, therefore, could result in a significant impact.



VRM Class III areas within BLM's Decision Area portion of this basin area constitute 26,806 acres. These lands primarily occur along the interstate and State highways within the Decision Area. The majority of Decision Area lands within this basin are designated as VRM Class IV, totaling 591,883 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

*Tularosa Basin* Within the Tularosa Basin 4,277 acres are designated as VRM Class I, all of which is closed to leasing. These VRM Class I areas include the Sacramento ACEC and Three Rivers Petroglyph Site ACEC.

VRM Class II areas open to leasing within the Tularosa Basin portion of BLM's Decision Area constitutes 12,492 acres, primarily skirting the foothills of the Sacramento Mountains. However unlikely, the RFD could be concentrated within areas designated as VRM Class II within the Tularosa Basin. Development in VRM Class II areas should not be visually evident.

VRM Class III areas within BLM's Decision Area constitute 75,615 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within the Tularosa Basin are designated as VRM Class IV, 210,225 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

*Jornada del Muerto Basin* No VRM Class I areas exist within this basin. VRM Class II areas within the basin portion of BLM's Decision Area constitute 777 acres, including the Jornada del Muerto WSA. The RFD could be concentrated within areas designated as VRM Class II open to leasing within the basin; however, impacts should not be visually evident.

VRM Class III areas within BLM's Decision Area constitute 3,035 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within this basin are designated as VRM Class IV, 273,512 acres, where impacts may begin to dominate the landscape. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

*Rio Grand/Mimbres/Gila River Basins* No VRM Class I areas exist within this basin area. VRM Class II areas open to leasing within BLM's Decision Area portion of this basin area constitutes 59,467 acres, primarily skirting the foothills of the Caballo Mountains and Reservoir. The RFD could be concentrated within areas designated as VRM Class II within the basin area, although visual impacts should not be evident.

VRM Class III areas within BLM's Decision Area constitute 204,340 acres. These lands primarily occur along the interstate and State highways within BLM's Decision Area. The majority of Decision Area lands within this basin area are designated as VRM Class IV, 447,352 acres. According to BLM Visual Resource Management Guidelines, development within areas designated as VRM Class III should remain subordinate to the existing landscape.

## Alternative A

As explained in Chapter 2, Alternative A represents a modification of (alternative to) existing management direction (No-action Alternative). Alternative A incorporates legislative and regulatory requirements and/or management objectives that likely would be specified on a case-by-case basis under existing management.

Table 4-9 summarizes the approximate acres by basin of surface lands that are closed or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres of Decision Area lands within each basin area and acres overlying Federal fluid minerals.

**TABLE 4-9**  
**ALTERNATIVE A**  
**CONSTRAINTS IN DECISION AREA BY BASIN**  
**(approximate acres)**

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/Mimbres/Gila River
<b>Closed to Leasing</b>				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	12,209	6,349	0	0
<b>Open to Leasing</b>				
No surface occupancy	90,039	41,291	1,928	27,178
Controlled surface use and timing limitation	58,470	993	12,713	90,321
Controlled surface use	199,283	139,791	257,541	259,547
Timing limitation	0	29,632	581	0
Standard lease terms and conditions	348,207	90,665	819	339,402
Total acres	746,580	310,133	277,915	718,379
Total acres overlying Federal minerals	745,272	309,135	277,691	714,190

## Lands and Access

*Salt/Pecos River Basins* Under Alternative A, a total of approximately 50,581 acres (about 7 percent) of BLM's Decision Area within this basin area would remain the same as the No-action Alternative;

i.e., closed to leasing. Approximately 90,039 acres (12 percent) would be open to leasing with a stipulation for no surface occupancy. Approximately 257,753 acres (34 percent) of BLM's Decision Area would be managed as open to leasing with stipulations for controlled surface use, timing limitation, or both. Approximately 348,207 acres (47 percent) would continue to be managed as open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (7 percent) and constrained with a stipulation for no surface occupancy (12 percent) and the area surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands within this basin area or on the ability to explore for or exploit fluid minerals are expected to be minimal.

*Tularosa Basin* As is the case under the No-action Alternative, a total of approximately 7,761 acres (3 percent) would be closed to leasing. Approximately 41,291 acres (13 percent) would be open to leasing with a stipulation of no surface occupancy. The majority of BLM's Decision Area would be managed as open to leasing with stipulations of controlled surface use, timing limitation, or both. The remaining 90,665 acres (29 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (2 percent) and constrained with a stipulation of no surface occupancy (13 percent) and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

*Jornada del Muerto Basin* As is the case under the No-action Alternative, a total of approximately 4,333 acres (2 percent) would be nondiscretionarily closed to leasing. Approximately 1,928 acres (less than 1 percent) would be open to leasing, but with a stipulation for no surface occupancy. The majority of the Decision Area (270,835 acres, or 97 percent) would be managed as open to leasing with stipulations for controlled surface use, timing limitation, or both. The remaining 819 acres (less than 1 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage of Decision Area land that is closed to leasing (2 percent) and constrained with a stipulation for no surface occupancy (less than 1 percent) and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands are not anticipated to be significant. However, as under the No-action Alternative, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone, which is within a area estimated to have a medium potential for oil and gas resources, may have an effect on industry's decision regarding leasing and development.

*Rio Grande/Mimbres/Gila River Basins* A total of approximately 1,931 acres (less than 1 percent) within this basin area would be closed to leasing. Approximately 27,178 acres (4 percent) would be open to leasing but with a stipulation for no surface occupancy. Approximately 349,868 acres (49 percent) would be managed as open to leasing with stipulations for timing limitation and controlled surface use. The remaining 339,402 acres (47 percent) would be open to leasing with standard lease terms and conditions.

Considering the small percentage (less than 1 percent) of Decision Area lands are closed to leasing in this basin area and 4 percent would be constrained with no surface occupancy and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands or on the ability to explore for or exploit fluid minerals are expected to be minimal.

### Minerals

Overall, the surface management constraints as well as required mitigation procedures and best management practices (refer to Appendices A-3 and A-5) imposed by Alternative A are not anticipated to significantly impact the ability to explore for or exploit oil and gas resources. Surface management requirements potentially may burden the project economics such that the project activities may be delayed. Some surface managements are more financially burdensome to the operators, such as closed pit systems or avoidance management that may require the use of directional drilling. The cost of the management requirements versus the anticipated revenue of the project may make the project infeasible. However, since BLM projects that the stipulations imposed under Alternative A most likely would be conditions of approval attached to APDs under existing management, the overall additional burden is not anticipated to be significant.

The areas of no surface occupancy (NSO) have increased under Alternative A versus the No-action alternative in all basin areas. Many of the NSO areas are small and the resource availability is not anticipated to be greatly affected; however, NSO is imposed in the Otero Mesa area to protect several patches of remnant desert grassland habitat. The feasibility and cost to reach the fluid minerals beneath these NSO areas would be impacted. Depending on the depth to the resource and other stratigraphic and structural aspects influencing the drilling program of the well, directional drilling to reach the underlying fluid minerals may not be feasible due to technical issues or cost. The resulting impact of the NSO areas is project specific and cannot be fully evaluated in a programmatic EIS. However, if NSO areas coalesce and become large enough that directional drilling is highly unlikely, then the majority of the NSO area is essentially closed to leasing. It is this aspect of the NSO areas that a programmatic EIS can evaluate and is assessed below by area.

*Salt/Pecos River Basins* No additional land would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 47 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 100 percent under existing management). Overall, the constraints imposed under Alternative A and most surface use requirements would not preclude the ability to explore for or exploit the oil and gas resources; however, NSO imposed in the Otero Mesa area to protect several patches of remnant desert grassland habitat allows use of the surface within 492 feet (150 meters) of existing roads and allows no surface use within the patches of grassland habitat. Generally, the patches proposed for protection are greater than 350 acres. Also, an area in T. 26 S., R. 18 E. does the stipulation for no surface occupancy of the buffer zones around playa lakes and riparian area coalesce into an area where the ability to exploit potential oil and gas resources would be impacted, as the area is effectively closed. As not all playa or riparian areas were mapped for this assessment, other areas also may potentially be closed by coalescing areas with a stipulation for no surface occupancy after a site inspection. However, it is not anticipated that the overall ability of the industry to explore for or exploit oil and gas resources would be significantly impacted by the controlled surface use requirements under this alternative.

*Tularosa Basin* Only minor additional lands from those closed under existing management would be closed to leasing under Alternative A (approximately less than 1 percent) and are not anticipated to impact the exploration and exploitation of oil and gas resources. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 29 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 100 percent under existing management). The constraints imposed by Alternative A as well as the surface use requirements are not anticipated to restrict the industry's ability to explore for or exploit oil and gas resources. Coalescing additional riparian/wetland/playa buffer zones with a stipulation for no surface occupancy is possible in this basin due to the incomplete inventory of the areas, but is not anticipated to impact the exploration or exploitation of oil and gas resources.

*Jornada del Muerto Basin* No lands additional to those closed under existing management would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (less than 1 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 15 percent under existing management). The constraints imposed by Alternative A as well as the surface use requirements are not anticipated to restrict the ability to explore for or exploit oil and gas resources. Coalescing additional riparian/wetland/playa buffer zones with a stipulation for no surface occupancy is probable in this basin due to the incomplete inventory of the areas, but is not anticipated to impact the exploration or exploitation of oil and gas resources. As stated above, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone, which is within the area estimated to have a

medium potential for oil and gas resources, may have an effect on industry's decision regarding leasing and development.

*Rio Grande/Mimbres/Gila River Basins* No lands additional to those closed under existing management would be closed to leasing under Alternative A. Leasing stipulations would increase under Alternative A by incorporating more controlled surface use (approximately 47 percent of the public lands would be leased under standard terms and conditions in Alternative A versus almost 99 percent under existing management). These additional surface use requirements are not anticipated to restrict the ability to explore for or exploit the oil and gas resources. These surface use requirements likely would have been specified as conditions of approval on APDs under existing management.

### Soils

This alternative is similar to the No-action Alternative in that it reflects the existing management decisions that normally would be required to meet resource condition objectives to manage the soil resource. Soils management under Alternative A includes stipulations for controlled surface use in areas where highly erosive or fragile soils and slopes are present. Occupancy or use of highly erosive or fragile soils would be considered and controlled on a case-by-case basis. On those soils that are on slopes greater than 5 percent, mitigation measures may be applied (e.g., waterbars, reseeding, pad design changes, etc.) Impacts on fragile soils are anticipated to be less under Alternative A than under existing management due to mitigation associated with the controlled surface use stipulations. Impacts on known and potential prime farmland are anticipated to be similar to those of the No-action Alternative. Impacts on soil resources are expected to be minimal under Alternative A.

### Water Resources

#### Groundwater

Most of the leasing stipulations under this alternative are controlled surface use. Therefore, impacts on groundwater resources are anticipated to be similar to those identified under the No-action Alternative throughout BLM's Decision Area.

#### Surface Water

Areas identified as sensitive in the No-action Alternative also are sensitive under this alternative. Under Alternative A, the BLM has identified surface use and management limitations for fluid minerals

activities in many sensitive use areas. Impacts on surface waters may be reduced by limiting surface disturbances by minimizing road construction. Leases within designated watersheds (see No-action Alternative for location by basin area) also would have controlled surface uses stipulated. Impacts on highly sensitive surface water bodies also would be reduced by providing a 0.25-mile (400-meter) buffer zone with a stipulation for no surface occupancy around riparian areas, wetlands, and playas. These controlled surface uses have the potential to decrease impacts that may occur during primarily the construction and abandonment activities, but also during the production phase.

Therefore, impacts on surface water resources are anticipated to be less than under the No-action Alternative. However, since greater residual impacts would occur only where best management practices do not fully mitigate an impact, the reduction in impacts under this alternative relative to No-action Alternative is not quantifiable. Based on protection of surface waters as provided by existing management and additional limitations as described under Alternative A, it is expected that impacts on surface water resources would be minimal.

### Vegetation

Stipulations for vegetation under this alternative vary from standard lease terms and conditions for desert scrub, arroyos, malpais and various unclassified types to controlled surface use for grassland, montane scrub, and woodland/forest vegetation. Patches of remnant desert grasslands in the Otero Mesa and Nutt areas would be protected by a stipulation of NSO. Also, areas within 0.25 mile (400 meters) of riparian and wetland/playa vegetation would be managed with a stipulation of no surface occupancy. Playas have been grouped with wetlands because they are jurisdictional to Section 404 of the Clean Water Act as Waters of the United States. Within BLM's Decision Area, stipulations would apply to approximately 347,792 acres (47 percent) of the Rio Grande/Mimbres/Gila River Basins; 211,700 acres (69 percent) of the Salt/Pecos River Basin; 272,763 acres (98 percent) of the Tularosa Basin; and 377,046 acres (52 percent) of the Jornada del Muerto Basin. Due to the stipulations and use of other mitigating measures, impacts on vegetation are expected to be minimal.

### Wildlife

Fluid mineral activities generally are allowed throughout the lease areas (unless specific areas are protected by other stipulations), but because of resource concerns, lease activities must be controlled. For big game, the stipulation of controlled surface use is designed to ensure that adequate habitat is maintained in a given area. Only herds for which specific goals were identified in the RMPA would be managed under stipulations of controlled surface use. Under this stipulation, development of an area

requires the maximum use of existing road and/or other utility corridors to minimize the potential for increased habitat fragmentation. Riparian/wetland habitats and playas are protected further by this stipulation. This stipulation also is imposed in areas where active raptor nests are present.

Leases within habitat occupied by bighorn sheep would be subject to stipulations of controlled surface use and timing limitations to minimize adverse impacts primarily during lambing seasons. Several areas within BLM's Decision Area have been identified as potential reintroduction sites for bighorn sheep. Bighorn sheep are sensitive to human activities; therefore, timing limitation would reduce the potential for adverse effects to the animal's productivity.

Stipulations of controlled surface use would be applied within raptor habitat, which is consistent with BLM management objectives. Specific raptor habitat and nests sites would be determined during site-specific investigations for individual APDs.

*Salt/Pecos River Basins* The Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use. This area contains one of the largest contiguous remnant grassland areas in the State. Under Alternative A, patches of this remnant desert grassland habitat within the Otero Mesa Habitat Management Area would be protected from further habitat fragmentation by a stipulation of no surface occupancy, which allows for surface use within 150 meters of existing roads and no surface use within the patches of grassland habitat. The patches proposed for protection are greater than 320 acres. This protection would be consistent with BLM's management goal of providing adequate habitat for pronghorn. The stipulations would be more effective than standard lease terms and conditions in reducing potential effects because it limits road construction in unroaded areas. This is especially important in areas adjacent to water sources and in areas where cover vegetation is present. Pronghorn utilize vegetation for cover as protection from predators or birthing. Controlling access into these areas would help reduce possible adverse effects on the productivity of the herd. The stipulations would help reduce adverse effects resulting from new road construction where roads are already in existence. The effectiveness of this stipulation is dependent on the location of the prospective wells relative to existing roads. Impacts associated with increased noise and activity levels would not be reduced. Mule deer habitat on Crow Flats would remain managed with standard terms and conditions.

*Tularosa Basin* The westernmost portion of the Otero Mesa Habitat Area is within the Tularosa Basin area (refer to maps 3-6 and 3-7). Refer to the relevant discussion in the paragraph above. The stipulation of controlled surface use also would be imposed on leases within the boundaries of the Sacramento Escarpment Deer Habitat Area. This is consistent with the BLM's management goal of providing adequate habitat for mule deer. Maximizing the use of existing roads would help reduce possible adverse effects of increased access and habitat fragmentation resulting from new road construction.



The Sacramento Mountains have been identified as an area suitable for reintroduction of bighorn sheep. Under Alternative A, stipulations of controlled surface use and timing limitation would be imposed on leases that are within habitat suitable for bighorn sheep. The lambing period for bighorn has been identified in some areas as January through June.

*Jornada del Muerto Basin* Under Alternative A, leases within the White Sands Antelope Area (Jornada Plain) would be subject to the stipulation of controlled surface use to protect the habitat. The purpose of delineating this habitat area in the 1986 RMP was to conduct studies to determine the biological factors limiting the distribution and numbers of pronghorn in this area. General management guidance states that forage will be provided for big game species in such delineated (herd unit) areas. Consistent with the management goal in the 1986 RMP, BLM's best management practice (Appendix A-III) encourages the use of existing roads to the maximum extent practical and minimizing new roads in unroaded areas and controlled surface use (Appendix VI, big game habitat areas) stipulates protection of habitat through avoidance of known habitat.

*Rio Grande/Mimbres/Gila River Basins* The Nutt Antelope Area and Caballo Mountains Deer Habitat Area are located within this basin. Leases within these two areas would be subject to stipulations of controlled surface use. However, the Nutt Antelope Area contains large patches of remnant desert grassland habitat. A stipulation of NSO would be imposed which would allow use of the surface within 492 feet (150 meters) of existing roads and no surface use within the habitat patches. The purpose is to protect against further habitat fragmentation. BLM management guidelines within the Nutt Antelope Area are the same as those for the White Sands pronghorn herd. That is, the area is to be used to conduct studies to determine the biological factors limiting the distribution and numbers of animals in this habitat. BLM guidance states that forage will be provided for big game species in this area. BLM's management objective for the Caballo Mountains Deer Habitat Area is to provide adequate habitat for mule deer. Limiting new road construction under the stipulation of controlled surface use would reduce effects of fragmentation and increased access.

The Caballo Mountains have been identified as a potential reintroduction area for bighorn sheep. The stipulations of controlled surface use and timing limitation would be attached to any lease within habitat suitable for bighorn sheep. This would reduce potential adverse effects to the productivity of a herd.

### Special Status Species

A summary of the protection provided by stipulations under Alternative A follows.

General direction imposed by this alternative would manage the majority of special status species and their habitats under stipulations of controlled surface use. For many of these species, a stipulation of timing limitation may be imposed. One special status species, the desert bighorn sheep, would be managed under stipulations of controlled surface use and timing limitation as described in the previous section on wildlife. Although this direction is provided by Alternative A, potential site-specific impacts would have to be identified through analysis at the time of an APD and prudent operation measures would be developed as conditions of approval attached to the APD.

Special status species likely to occur in each of the basins are listed under the No-action Alternative (Existing Management) and potential impacts are discussed under the section titled “Common Impacts.”

Areas where these Federally listed or BLM-sensitive species are known to occur would be managed with a lease stipulation of controlled surface use, whereby operations would be designed to avoid disturbance of individuals of listed plant populations. Each project would be scrutinized for potential effects on listed wildlife species and their suitable and potential habitat. There would be a high potential for timing limitations and other conditions of approval resulting from BLM analysis and consultation with the U.S. Fish and Wildlife Service (FWS). Similarly, areas where these State-listed species are known to occur would be managed with a stipulation for controlled surface use, whereby operations would be designed to avoid delineated populations.

As mentioned previously, riparian areas, wetlands, and playas would be managed with a stipulation of no surface occupancy within 0.25 mile (400 meters) of these areas to avoid direct impacts on special status species that utilize these areas. Potential water contamination of these resources would be minimized in accordance with other BLM guidelines.

Crucial habitat would be managed with a stipulation of controlled surface use, whereby new disturbances would be minimized to reduce loss of habitat area and habitat fragmentation. In the Otero Mesa and Nutt areas, portions of the remnant desert grasslands would be protected by a stipulation of NSO, which would allow use of the surface within 492 feet (150 meters) of existing roads and no surface use in adjacent grassland habitat. Areas of designated southwestern willow flycatcher habitat, which is riparian, would be managed with a stipulation of no surface occupancy within 0.25 mile (400) meters of riparian/wetland/playa areas.

Grassland habitats for the aplomado falcon would be managed under a stipulation of controlled surface use, whereby new disturbances would be minimized to reduce loss of habitat and habitat fragmentation and to avoid disturbance and/or displacement of individuals. A timing limitation may be required to avoid impacts on nesting falcons between January 1 and July 31. If needed, site-specific plans to avoid impacts on the aplomado falcon would be coordinated with the FWS.

Areas where black-tailed prairie dogs are known to occur would be managed with a stipulation of controlled surface use, whereby operations would be relocated to avoid prairie dog towns.

Occupied habitat for bighorn sheep would be managed with stipulations for controlled surface use and timing limitation, whereby new disturbances would be minimized to reduce loss of habitat and habitat fragmentation. The stipulation of timing limitation provides that no exploration or construction can occur in habitat occupied by bighorn sheep during lambing seasons.

The eight nominated ACECs would be managed with stipulations of controlled surface use designed to protect resource values. These are listed in Section 3.18.3.

Special status species that may occur within the Decision Area are listed by basin in the special status species section under the No-action Alternative. Assuming that operators comply with the lease stipulations, conditions of approval, and other guidelines, impacts on special status species are expected to be minimal.

### Rangeland

Under Alternative A, no specific lease stipulations have been developed for rangeland and livestock grazing. However, the stipulation of controlled surface use that would be implemented for grassland, montane scrub, and woodland/forest vegetation also would serve to reduce impacts on grazing resources as well. Accordingly, riparian vegetation and wetlands, including playas would be managed under the stipulation of NSO within 0.25 mile (400 meters) of these areas, which would similarly reduce impacts on livestock grazing in these areas.

### Cultural Resources

As mentioned previously, regardless of the alternative, potential impacts on other resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of common impacts. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects.

*Salt/Pecos River Basin* The ACECs would remain discretionarily closed to leasing. Surface use would be controlled within 0.25 mile (400 meters) of the entire Butterfield Trail to protect this historic route.

*Tularosa Basin* The Three Rivers ACEC would remain discretionarily closed to leasing. The stipulation for the Rattlesnake Hill Archaeological District would be changed from no surface occupancy to a discretionary closure, and an adjacent 245 acres currently closed to ORV use would be managed with a stipulation of no surface use. Also, a larger adjacent area would be managed with a stipulation of NSO. The Lone Butte Archaeological District and Jarilla Mountains Archaeological District, currently closed to ORV use, would be managed with stipulations of controlled surface use.

*Jornada del Muerto Basin* Surface use would be controlled within 0.25 mile (400 meters) of the entire Jornada del Muerto Trail to protect this historic route.

*Rio Grande/Mimbres/Gila River Basins* The Lake Valley Historic Townsite would be managed with a stipulation of no surface occupancy. In addition, surface use would be controlled within 0.25 mile (400 meters) of the Mormon Battalion Trail to protect this historic route.

### Recreation

Under Alternative A, some recreation resources are provided additional protection. The Red Sands ORV Area would be managed with a stipulation of timing limitations in order to accommodate periods of heavier ORV activity and an annual race. In addition, the Cornudas Mountains, Cuchillo Mountains, and Lake Valley Back-country Byway would be managed with the stipulation of controlled surface use. These stipulations, designed mainly to protect visual resources, increase the protection for more passive recreation opportunities as well.

### Visual Resources

The differences between the No-action Alternative and Alternative A are the same for each hydrological basin, as described in this section. Under Alternative A, VRM Class I areas would be closed to leasing, VRM Class II areas would be managed with the stipulation of controlled surface use, and VRM Classes III and IV areas would be managed with standard lease terms and conditions.

Because areas designated as VRM Class I are closed to leasing under Alternative A, no visual resource impacts would occur in these locations as a result of field development.

In VRM Class II areas, the stipulation of controlled surface use would allow for short-term impacts as long as long-term impacts are consistent with the VRM Class II objectives. BLM guidance for areas of VRM Class II requires that changes in any of the basic elements in the characteristic landscape, caused

by management activity should not be evident in the characteristic landscape, and that contrast may be seen but must not attract attention. Under Alternative A, within an area of VRM Class II, requirements of controlled surface use may include painting facilities to blend with the surrounding vegetation and landscape and maximizing use of existing roads and utility corridors. Sensitive siting and mitigation planning of each site should reduce impacts on visual resources to be in compliance with BLM VRM classifications, and to less than significant levels.

In areas designated as VRM Class III and IV, where standard lease terms and conditions apply, field development within areas designated as VRM Class III potentially could result in significant visual impacts and noncompliance with BLM VRM objectives. Field development within areas designated as VRM Class IV is unlikely to result in noncompliance with BLM VRM objectives; however, significant impacts on sensitive viewers could occur within these locations.

## **Alternative B**

As explained in Chapter 2, Alternative B also represents a modification of (alternative to) existing management direction (No-action Alternative). While Alternative B incorporates legislative and regulatory requirements and/or management objectives, it provides for greater protection of resource concerns. Areas identified as fragile, of significant value, or in need of protection are closed to leasing or are open to leasing but protected by stipulations including no surface occupancy.

Table 4-10 summarizes the approximate acres by basin of Decision Area surface lands that are closed or open to leasing with stipulations or standard lease terms and conditions. Also, the table summarizes the total acres of Decision Area lands within each basin area and acres overlying Federal fluid minerals.

### Lands and Access

*Salt/Pecos River Basins* Under Alternative B, a total of 157,290 acres (21 percent) of BLM's Decision Area within this basin area would be closed to leasing. Approximately 100,297 acres (13 percent) would be open to leasing but with a stipulation of no surface occupancy. Approximately 168,553 acre (23 percent) of BLM's Decision Area would be open to leasing with stipulations of controlled surface use and/or timing limitations, and 320,442 acres (43 percent) would be open to leasing with standard lease terms and conditions.

**TABLE 4-10**  
**ALTERNATIVE B**  
**CONSTRAINTS IN DECISION AREA BY BASIN**  
**(approximate acres)**

Constraint	Basins			
	Salt/Pecos River	Tularosa	Jornada del Muerto	Rio Grande/Mimbres/Gila River
<b>Closed to Leasing</b>				
Nondiscretionary closure	38,372	1,412	4,333	1,931
Discretionary closure	118,918	80,052	2	80,136
<b>Open to Leasing</b>				
No surface occupancy	100,297	41,781	8,973	50,759
Controlled surface use and timing limitation	8,771	605	12,713	58,160
Controlled surface use	159,782	131,876	251,144	270,182
Timing limitation	0	0	581	0
Standard lease terms and conditions	320,442	54,405	169	257,227
Total acres	746,582	310,131	277,915	718,377
Total acres overlying Federal minerals	746,272	309,135	277,691	714,190

Considering that 65 percent of Decision Area lands within this basin area would be open to leasing with stipulations (other than no surface occupancy) or standard lease terms and conditions and the area of surface disturbance projected for the RFD is less than 1 percent of Decision Area lands, overall impacts on Decision Area lands are not anticipated to be significant.

*Tularosa Basin* A total of 81,464 acres (26 percent) of BLM's Decision Area would be closed to leasing and 41,781 acres (13 percent) would be open to leasing but with a stipulation of NSO. Approximately 132,481 acres (43 percent) of BLM's Decision Area would be open to leasing with stipulations of controlled surface use and/or timing limitations. The remaining lands would be open with standard lease terms and conditions (54,405 acres, or 18 percent).

Considering that 60 percent of Decision Area lands within this basin would be open to leasing with stipulations (other than no surface occupancy) or standard terms and conditions and the area of surface disturbance projected for the RFD is less than 1 percent, overall impacts on Decision Area lands are expected to be minimal.

*Jornada del Muerto Basin* A total of 4,333 acres (1.5 percent) of BLM's Decision Area would be closed to leasing and 8,973 acres (3 percent) would be open to leasing but with a stipulation of no surface occupancy. The majority of Decision Area lands (264,438 acres, or 95 percent) would be open to leasing with stipulations of controlled surface use, timing limitations, or both. The remaining lands would be open to leasing with standard lease terms and conditions (169 acres, or less than 1 percent).

Considering the small percentage of Decision Area lands closed to leasing (1.5 percent) or constrained with stipulations for no surface occupancy (3 percent), the 95 percent of lands open to leasing with stipulations (other than no surface occupancy) or standard lease terms and conditions, and the area of surface disturbance projected from the RFD (less than 1 percent), overall impacts on Decision Area lands in this basin are expected to be minimal. However, the timing limitation associated with the White Sands Missile Range Safety Evacuation Zone (83 percent of the Decision Area), which is within an area with a medium potential for oil and gas resources, may have an effect on industry's decisions regarding leasing and development.

*Rio Grande/Mimbres/Gila River Basin* A total of 82,067 acres (11 percent) of BLM's Decision Area would be closed to leasing and 50,759 acres (7 percent) would be open to leasing but with a stipulation of no surface occupancy. The majority of Decision Area lands (328,342 acres, or 46 percent) would be open to leasing with stipulation of controlled surface use and/or timing limitations, and 257,227 acres (36 percent) would be open with standard lease terms and conditions.

Considering that 82 percent of Decision Area lands within this basin area would be open to leasing with stipulations (other than no surface occupancy) or with standard lease terms and conditions and the area of surface disturbance projected for the RFD (less than 1 percent), overall impacts on Decision Area lands are expected to be minimal.

## Minerals

Under Alternative B, the protection of other resources takes precedence over the ability to explore for or exploit oil and gas resources. If a significant portion of additional land is closed to leasing, the ability to explore for oil and gas resources would be impacted and could be significantly impacted locally. Additionally, limiting geophysical exploration on discretionarily closed areas also may limit the ability to fully explore and evaluate open adjacent lands. In general, the ability to explore for and exploit the oil and gas resources is anticipated to be impacted, and possibly significantly impacted in the Rio Grande/Gila River/Mimbres, Salt/Pecos River, and Tularosa Basins.

As described in Alternative A, other surface management requirements also can impact the feasibility of a project due to cost of implementation. Areas of NSO have increased in Alternative B both in number and in size, but as the contiguous NSO areas are small the resource availability is not anticipated to be greatly affected. However, the feasibility and cost to reach the underlying fluid minerals beneath these areas will be impacted. The resulting impact of the NSO areas is project specific and cannot be evaluated fully in a programmatic EIS. However, if NSO areas coalesce and become large enough that

directional drilling is highly unlikely, then the majority of the NSO area is essentially closed to leasing. It is this aspect of the NSO areas that a programmatic EIS can evaluate and is assessed below by area.

*Salt/Pecos River Basins* Fifteen percent of lands open to leasing under existing management would be closed to leasing under Alternative B (additional 12 percent of the total Federal minerals would be closed). Constraints also would increase under Alternative B by incorporating the stipulation of controlled surface use. However, most surface use requirements would not directly restrict the industry's ability to explore for or exploit the oil and gas resources, but may indirectly impact the ability to explore and exploit reducing the feasibility of the project. These controlled surface uses are generally the same as Alternative A with the exception that buffer zones managed with a stipulation of no surface occupancy are increased from almost a 0.25 mile (400 meters) to 0.5 mile (800 meters) around riparian/other wetlands/playas. Two areas (in T. 26 S., R. 18 E. and T. 26 S., Rs. 16 and 17 E.) have buffer zones managed with the stipulation of no surface occupancy around playa lakes and riparian areas, which coalesce into an area where the ability to exploit potential oil and gas resources would be restricted just as if that the area is effectively closed. As not all playa or riparian areas were mapped for this assessment, other areas potentially could be effectively closed if identified as sensitive. The areas of NSO associated with the desert grassland habitat in the Otero Mesa Habitat Management Area would remain the same as Alternative A. It is anticipated that the overall ability of the industry to explore for or exploit the oil and gas resources would be impacted by the closures and areas of no surface occupancy, and could be significantly impacted locally.

*Tularosa Basin* Twenty-four percent of lands open to leasing under existing management would be closed to leasing under Alternative B (additional 4 percent of the total Federal minerals would be closed to leasing). These additional closures are anticipated to impact the exploration and exploitation of oil and gas resources in combination with the closures of military land and incorporated cities, towns, and villages. Leasing stipulations also would increase under Alternative B by incorporating the stipulation of controlled surface use. However, most surface use requirements would not directly restrict the industry's ability to explore for or exploit oil and gas resources, but may indirectly impact that ability by decreasing the feasibility of the project. These stipulations of controlled surface use generally are the same as Alternative A with the exception that buffer zones managed with the stipulation of no surface occupancy are increased from almost a 0.25 to 0.5 mile (400 to 800 meters) around riparian/other wetlands/playas. As not all playa or riparian areas were mapped for this assessment, areas potentially could be effectively closed by coalescing additional buffers managed with stipulations of NSO. The western portion of the Otero Mesa desert grassland habitat area, portions of which would have a stipulation of NSO, are within this basin area. It is anticipated that the overall ability of the industry to explore for or exploit oil and gas resources would be impacted by the closures and areas of no surface occupancy, and could be significantly impacted locally.



*Jornada del Muerto Basin* Only very minor amounts of additional lands would be closed discretionarily to leasing under Alternative B (approximately 2 acres). Leasing stipulations would increase under Alternative B by incorporating more stipulations of controlled surface use. These additional surface use requirements are not anticipated to directly restrict the industry's ability to explore for or exploit oil and gas resources unless areas managed with the stipulation of no surface occupancy are identified due to the lack of a complete inventory of playas. As buffer zones managed with the stipulation of no surface occupancy are increased in Alternative B from almost a 0.25 mile (400 meters) in Alternative A to 0.5 mile (800 meters) around riparian/wetlands/playas, the potential for coalescing riparian/other wetland/playa buffer zones managed with a stipulation of no surface occupancy are probable in this basin. The impact on the ability to explore for and exploit oil and gas resources in the Jornada del Muerto Basin is not anticipated to be significant; however, the presence of noninventoried playas potentially may provide areas of coalescing buffer managed with the stipulation of no surface occupancy. Leasing stipulations of surface management may indirectly impact the industry's ability to explore for and exploit oil and gas resources by requiring significant changes to the drilling plan to make the project infeasible either technically or costly.

*Rio Grande/Mimbres/Gila River Basins* Eleven percent of lands open to leasing under existing management would be closed to leasing under Alternative B (11 percent of the total Federal minerals would be closed as opposed to less than 1 percent under the No-action Alternative). These additional closures are anticipated to impact the exploration and exploitation of oil and gas resources but not as greatly as in other portions of the Decision Area as 89 percent of the Federal minerals would still be open to leasing in the basin. Leasing stipulations also would increase under Alternative B by incorporating more stipulations of NSO and controlled surface use. However, most surface use requirements would not directly restrict the industries ability to explore for or exploit the oil and gas resources but may indirectly impact that ability by decreasing the feasibility of the project. The stipulation of controlled surface use generally is the same as Alternative A with the exception that buffer zones managed with the stipulation of no surface occupancy is increased from almost 0.25 to 0.5 mile (400 to 800 meters) around riparian/other wetlands/playas. It is anticipated that the overall ability of the industry to explore for or exploit the oil and gas resources would be impacted by the closures under this alternative. However, given the proportion of non-Federal minerals and the overall percentage of Federal minerals still open to leasing, the impact is expected to be minimal overall but could be significantly impacted locally.

## Soils

Anticipated impacts on soil resources under Alternative B are similar to Alternative A. Impacts on soils on slopes and the indirect impacts on water resources are anticipated to be less due to guidance provided by best management practices (Appendix A-III).

## Water Resources

In general most lease stipulations under this alternative control surface uses. Therefore, impacts on groundwater resources are anticipated to be similar to those identified under the No-action Alternative. Areas of exception would include lands that are closed to leasing or associated with the stipulation of no surface occupancy, which may limit the development of the minerals and further limit the potential for impact on the groundwater resources. The impacts on groundwater resources are expected to be minimal.

Areas identified as sensitive in the No Action Alternative and Alternative A also are sensitive in this alternative and have been given additional protection. Under Alternative B, the BLM has identified surface management limitations for fluid minerals activities that control surface use as described in Alternative A. Additionally, impacts in the designated watersheds (see No Action Alternative for location by analysis area) would be nonexistent due to discretionary closure of these areas. These areas would obtain further protection as geophysical exploration would not be allowed. Impacts on highly sensitive surface water bodies would be reduced further from Alternative A by providing a 0.5-mile (800-meter) buffer zone of no surface occupancy around riparian areas, other wetlands, and playas. These controlled surface uses have the potential to decrease or eliminate impacts that occur during primarily the construction and abandonment activities, but also during the production phase.

## Vegetation

The areas specified for the various stipulations are similar to Alternative A in that standard lease terms and conditions are applied to desert scrub, arroyos, malpais, and various unclassified types, and grassland, montane scrub, and woodland/forest vegetation would be managed with stipulations of controlled surface use. Riparian and wetland/playa vegetation are associated with the more restrictive stipulation of no surface occupancy. The stipulation of no surface occupancy would apply to a total of 201,810 acres within BLM's Decision Area, ranging from less than 1 percent to 13 percent of the surface area within the basins. Because of protective stipulations and other mitigating measures, it is unlikely that impacts on vegetation would be significant.

## Wildlife

Under Alternative B, generally, protection through discretionary closures and NSO would increase.

*Salt/Pecos River Basins* Management would be the same as that described for Alternative A. That is, the Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use and the remnant patches of desert grassland within the Otero Mesa Habitat Area would be protected with the stipulation of no surface occupancy (which allows for surface use within 150 meters of existing roads and no surface use within the patches of grassland habitat).

*Tularosa Basin* Management would be the same as that described for Alternative A. That is, the westernmost portion of the Otero Mesa Habitat Area would be protected with the stipulation of controlled surface use and the remnant patches of desert grassland within the Otero Mesa Habitat Area would be protected with the stipulation of no surface occupancy (as described in the paragraph above). The stipulation of controlled surface use also would be imposed on leases within the boundaries of the Sacramento Escarpment Deer Habitat Area except in areas where the Habitat Area coincides with the Sacramento Escarpment ACEC, which is closed to leasing. Stipulations of controlled surface use and timing limitation would be imposed on leases that are within habitat suitable for bighorn sheep.

*Jornada del Muerto Basin* The stipulations of controlled surface use would be applied to leases within the Jornada del Muerto Habitat Area. The addition of a timing limitation would mitigate potential effects of activities occurring during the birthing season. Such areas would be identified on a site-specific basis at the time of an APD.

*Rio Grande/Mimbres/Gila River Basins* The stipulation of controlled surface use would be applied to leases within the Nutt Antelope Area and habitat suitable for bighorn sheep in the Caballo Mountains. Leases within the Caballo Mountains Deer Habitat would be subject to the stipulation of controlled surface use, as under Alternative A.

### Special Status Species

Generally, Alternative B affords greater protection for special status species. Areas where Federally listed or BLM sensitive species are known to occur would be discretionarily closed to leasing. Areas where State-listed species are known to occur would be managed with stipulations for controlled surface use, whereby operations would be designed to avoid delineated populations and there would be a high potential for timing limitations and other conditions of approval following BLM analysis.

Areas of riparian/other wetland/playa habitat, including a 0.5-mile (800-meter) buffer, would be managed with the stipulation of no surface occupancy to reduce impacts on special status species that utilize these areas. Potential water contamination of riparian/other wetland/playa areas from offsite sources could result in indirect impacts to special status species, but would be minimized in accordance with other BLM guidelines.

Crucial habitats would be managed with standard lease terms and conditions as under the No-action Alternative and Alternative A. Areas of designated southwestern willow flycatcher habitat, which is riparian, would be discretionarily closed to leasing and protected further by the stipulation of no surface occupancy within 0.5 mile (800 meters) of these areas. Grassland habitats for the aplomado falcon would be managed with the stipulation of controlled surface use as under Alternative A. Areas where the Arizona black-tailed prairie dog is known to occur would be managed with the stipulation of no surface occupancy on known towns and controlled surface use in habitat suitable for the prairie dog. Habitat suitable for bighorn sheep would be managed with stipulation of controlled surface use combined with a timing limitation as under Alternative A.

The eight nominated ACECs would be discretionarily closed to leasing to protect resource values.

Special status species that may occur within BLM's Decision Area are listed by basin in the special status species section under the No-action Alternative. Assuming that operators comply with the lease stipulations, conditions of approval, and other guidelines, impacts on special status species are not anticipated to be significant.

### Rangeland

No specific lease stipulations have been developed for rangeland and livestock grazing. Riparian vegetation and wetlands would be afforded additional protection in that no surface occupancy would be allowed within 0.5 mile (800 meters) of these areas.

### Cultural Resources

In general, potential impacts on cultural resources would be reviewed and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation those effects.

*Salt/Pecos River Basin* the ACECs would remain discretionarily closed to leasing. Protection of the Butterfield Trail would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

*Tularosa Basin* The Three Rivers ACEC would remain discretionarily closed to leasing. Alternative B enhances protection of the Rattlesnake Hill Archaeological District, which would remain discretionarily

closed to leasing and surrounding areas also would be discretionarily closed to leasing. The Lone Butte Archaeological District would be managed with a stipulation of no surface occupancy as under Alternative A and protection of the Jarilla Mountains Archaeological District would be enhanced by closing it to leasing.

*Jornada del Muerto Basin* Protection of the Jornada del Muerto Trail would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

*Rio Grande/Mimbres/Gila River Basins* The Lake Valley Historic Townsite would be discretionarily closed to leasing. Protection of the Mormon Battalion Trail also would be enhanced with a stipulation of no surface occupancy within 0.25 mile (400 meters) of the entire trail.

### Recreation

Under this alternative, nearly all recreation resources of concern would be discretionarily closed to leasing. Impacts on recreation are expected to be minimal.

### Visual Resources

Under Alternative B, VRM Classes I and II areas are discretionarily closed to leasing, VRM Class III would be open to leasing and managed with a stipulation of controlled surface use, and VRM Class IV would be open to leasing with standard lease terms and conditions.

Because areas designated as VRM Classes II and I, are closed to leasing, no visual resource impacts would occur in these locations as a result of development of the RFD.

In areas designated as VRM Class III, stipulations of controlled surface would allow for short-term impacts as long as long-term impacts are consistent with the VRM Class III objectives. BLM guidance for areas of VRM Class III requires that changes to the basic elements in the characteristic landscape, caused by management activity may be evident, but should remain subordinate to the existing landscape. Under alternative B, within areas of VRM Class III, controlled surface use may include painting facilities to blend with the surrounding vegetation and landscape, minimizing pad size, and maximizing use of existing roads and utility corridors. Sensitive siting and mitigation planning for each site should reduce impacts on visual resources to be in compliance with BLM VRM classifications, and to less than significant levels.

In areas designated as VRM Class IV, where standard lease terms and conditions apply, field development is likely to comply with BLM VRM objectives; however, significant impacts on sensitive viewers could occur within these locations.

#### **4.3.2 Geothermal Resources**

Only areas exhibiting a “high” potential for geothermal resources in BLM’s Decision Area (see Map 3-4) are evaluated and, therefore, only potential impacts within the Rio Grande/Mimbres/Gila River Basins are presented below. Generally, impacts would be the same regardless of the alternative due to the overall low level of surface disturbance necessary to achieve the RFD.

#### **Lands and Access**

As projected by the RFD, a total of approximately 26.6 acres would be disturbed for development of geothermal resources. Due to the small area of surface disturbance and closure to leasing of incorporated cities, towns, and villages, impacts on land use are expected to be minimal. For geothermal development, needed access is expected to total approximately 12 acres. In general, geothermal resources are used on-site and drilling activities can be conducted along existing access routes. Geothermal resources likely would be applied to a direct use; specific land use or traffic impacts that may be associated with that use may be addressed in the APD.

#### **Minerals**

The production of geothermal resources (heat) is a renewable resource; therefore, no impact on the resource has been identified. Surface and subsurface management within the Planning Area has the potential to impact the ability to explore for or exploit the geothermal resources.

Three areas of high geothermal potential were identified in this basin area. Two of these areas are along the Rio Grande and its associated reservoirs, and one is located in the vicinity of the town of Truth or Consequences. Therefore, only limited portions of these two high potential areas overlie Federal fluid minerals. Under the No-action Alternative or Alternative A, these lands are open to leasing with standard lease terms and conditions and no impact on the ability to explore for and exploit geothermal resources is anticipated. Under Alternative B, most of the Decision Area lands in the high potential geothermal areas around Truth or Consequences and the Derry area would be closed to leasing. Therefore, only one of the three areas of high geothermal potential could be explored and exploited.

This could result in an impact on the ability to explore for and exploit lands in areas of high geothermal potential.

## **Soils**

Nickel-bluepoint soils are located in the areas of high potential for geothermal resources in the vicinity of Derry and Truth or Consequences. These soils are identified as fragile and as known or potential prime farmland. No fragile soils or known or potential prime farmland are identified in the Hillsboro area, also an area of high potential for geothermal resources; however, the area contains slopes with high grades.

Predictable short-term impacts include loss of topsoil and increased erosion, which are likely to be limited to new development. Long-term impacts on soil resources in the form of increased roadway construction and construction of production facilities, are similar to the oil and gas activities. Since the development of hydroponic crop production or aquiculture is a likely end use of the geothermal resource, if known or potential prime farmland is taken out of production, the resulting land use may increase the productivity of the land though not the soils themselves.

Subsidence may occur as a result of geothermal development. However, it is expected to be minor and could be mitigated through the use of injection wells.

Overall, the impacts on soil resources from geothermal activities are anticipated to be similar to those anticipated under oil and gas activities. Variation between alternatives also are similar.

## **Water Resources**

### Groundwater

Impacts on groundwater resources are identified in Impacts Common to All Alternatives and as described for the Rio Grande/Mimbres/Gila River Basins in the oil and gas section above. An important issue related to water quality is the method of disposal of spent geothermal fluids. As geothermal facilities pump and manage water entirely at the facility and do not require any trucking of wastewaters, the anticipated impacts from spills would be less. However, the amount of wastewater generated is likely to be much greater for the geothermal facility and therefore the likelihood of impact on-site becomes greater. Overall potential impacts on groundwater resources are not anticipated to vary by alternative other than in Alternative B, in which the impacts on groundwater resources may be less due to some areas not being available for leasing. In particular most of the high potential geothermal areas around Truth or Consequences and the

Derry area would be closed to leasing. Impacts on groundwater resources are expected to be minimal under any alternative.

### Surface Water

Impacts on surface water resources are anticipated to be the same as those Impacts Common to All Alternatives. Spills of produced water, which could be highly mineralized, likely would be of most concern. Activities more likely to occur near surface water features have the greatest potential to impact surface water quality. Potential direct impacts on surface waters include detention pond leaks or breaches resulting in discharge of highly saline or highly mineralized water into receiving surface waters, as well as accidental releases of contaminants.

### **Air Quality**

Impacts on air quality would be the same as those for oil and gas operations. The airborne effluents associated with construction are the primary concern, and can be mitigated.

### **Noise**

Impacts from noise would be similar to noise impacts described for oil and gas operations.

### **Vegetation**

Some direct loss of vegetation would result from the construction of roads, wells, and other facilities. Due to the small amount of surface disturbance and assuming the use of mitigation and reclamation measures, impacts to vegetation are expected to be minimal.

### **Wildlife**

Increased human activity, traffic, and noise could impact wildlife and use of habitat adjacent to project facilities. Alternatives A and B provide greater protection for habitats of concern through the use of the controlled surface use stipulation in some areas that overlap with high potential areas for geothermal resources.



## **Special Status Species**

The types of impacts on special status species from geothermal operations are anticipated to be similar to those described for each of the alternatives discussed in the oil and gas development section. Potential impacts on special status species would be identified through site-specific investigation at the time of an APD and prudent mitigating measures would be prescribed as conditions of approval as part of the APD.

## **Rangeland**

Impacts on rangeland and grazing from geothermal operations are expected to be minimal for any alternative.

## **Cultural Resources**

No cultural resources of particular concerns have been specially designated within BLM's Decision Area in the areas of high potential for geothermal resources. In general, potential impacts on cultural resources would be reviewed at the time of an APD and considered in accordance with Section 106 of the National Historic Preservation Act using the procedures outlined in the previous discussion of impacts common to all alternatives. Implementation of such procedures is expected to result in avoidance of any identified adverse effects or satisfactory mitigation of those effects.

## **Paleontological Resources**

Potential impacts on paleontological resources would be reviewed at the time of an APD, and if needed, measures would be developed as conditions of approval to mitigate the impacts.

## **Recreation**

Impacts on recreation resources from geothermal development would be similar to those described for oil and gas, although the acreage disturbed would be much less.

## **Visual Resources**

Potential impacts on visual resources from geothermal development are anticipated to be more localized than those resulting from oil and gas development. In geothermal development all of the facilities would be located at the source of the resource in a single location. Best management practices for reducing impacts on visual resources are summarized in Appendix A-III.

## **Social and Economic Conditions**

Fluid mineral development could potentially cause spillover into local communities in the form of jobs, supply contracts for construction materials and services, sales of retail goods and services to workers, taxes, and any associated requirements for police, fire, health and welfare services and facilities. Of concern is the capacity of the community to accommodate an influx of non-local workers and business. If it has the capacity, then the area prospers; if not, then some residents may suffer inconveniences or even losses from project-induced pressure on local resources. The construction phase offers the main opportunity for socioeconomic problems to develop, because it contains the bulk of labor force, logistical, and capital spending effects.

The geothermal resources most likely to be developed in the RFD study area are located in Sierra County in the vicinity of towns and communities such as Truth or Consequences, Arrey, and Derry. The resources are relatively low in temperature, i.e., less than 100 degrees Celsius, and relatively shallow (less than 500 feet [153 meters] ) (Geo-Heat 1998). As such, they could be exploited with conventional water well drilling technology. The capital costs to explore for, develop, and produce such a resource (including pumps, piping, and reinjection wells) run in the neighborhood of \$500,000 to \$750,000. Annual operating costs are on the order of \$40,000 to \$45,000 per year (excluding capital recovery). The manpower and material resources represented by these values are relatively insignificant, and as such would have very little impact on the local socioeconomic milieu. Local contractors could probably supply most of the inputs (including workers), so most of the economic benefit would accrue to the local communities. But the magnitude of the worker income and local procurements would be negligible in terms of economic stimulus.

The economic variables associated with the RFD will remain consistent through all the alternatives. However, some of the area that has been identified as high potential for geothermal is closed discretionarily in Alternative B.

## 4.4 CUMULATIVE EFFECTS

Regulations prepared by the Council on Environmental Quality (CEQ) for implementing NEPA require Federal agencies to analyze and disclose effects that result from incremental impact of an action “when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

Cumulative effects could result from fluid minerals activities occurring in the same or adjacent areas simultaneously. However, this RMPA/EIS is broad in scope and analyzes the fluid minerals program of the Las Cruces Field Office of BLM. The RMPA and Record of Decision will disclose the lands that are available for leasing and how those lands and resources will be managed for fluid minerals activities. At this programmatic level of analysis and the uncertainty of the location(s) of the potential fluid minerals activities, it is difficult to define the functional, temporal, and spatial relationships between potential fluid minerals activities and other past, present, and reasonably foreseeable future actions. Therefore, past, present, and potential reasonably foreseeable future actions are addressed generally here and will be considered on a case-by-case basis for each lease application and APD.

By comparing the direct and indirect impacts of the RFD with the potential effects of other actions, the relative contribution of the RFD to the cumulative impact or the effect that other actions may have on the ability for industry to achieve the RFD may be estimated. Because the RFD is the same for all alternatives, no variation in the level of cumulative impacts is anticipated among the alternatives.

Major past, present, and potential reasonably foreseeable future actions in BLM’s Decision Area are briefly described below.

### **Past Actions**

- # Within the Planning Area, a total of approximately 2,042,200 acres of lands are nondiscretionarily closed to leasing for military, recreation and preservation, and protective purposes.
- # Within BLM’s Decision Area, approximately 46,047 acres of land are nondiscretionarily closed to leasing and approximately 17,673 acres of land currently are discretionarily closed to leasing.
- # *Livestock grazing and rangeland improvements* Ranching and livestock grazing has been a predominant use of the land dating back to the 1880s when railroads arrived in the territory. Historically, grazing on public land has been authorized and numerous rangeland improvements such as fencing and watering sources have been developed.

- # *Habitat fragmentation* Encroachment of desert scrub into grasslands has been occurring over the past 80 to 90 years. This shift may be attributed to a combination of climatic change, introduction of roads, intensive livestock grazing, and concurrent interruption of naturally occurring fire (Dick-Peddie 1975, Nielson 1986).
- # *Copper Flat Mine* Copper has been pursued in the Copper Flats area northwest of Hillsboro since the mid 1950s, beginning with a small copper leaching operation and exploration. Exploration continued into the 1970s when sufficient reserves were defined to begin development. In 1982, an open pit copper mine was developed and operated. Operation continued intermittently until 1986.
- # *Navajo Pipeline* The Navajo Pipeline is a 12.75-inch-diameter pipeline that delivers petroleum products from the Navajo Refinery in Artesia, New Mexico to El Paso, Texas. The pipeline crosses through Otero County (across Otero Mesa).
- # *Diamond Shamrock Pipeline* The Diamond Shamrock Pipeline is a 10-inch-diameter petroleum products pipeline that parallels the Navajo Pipeline through Otero County.

### **Present Actions**

- # *Livestock grazing and rangeland improvements* Existing authorizations for livestock grazing and rangeland improvements occur on public land throughout the Planning Area.
- # *Habitat fragmentation* Authorizations resulting in removal of vegetation (habitat) and possible ongoing impacts from past habitat fragmentation continue to affect habitat.
- # *Bennett Ranch Gas Exploration* Existing lands have been leased in this area and exploration activities have begun.
- # *Otero Platform Geophysical Exploration* Notices of intent to explore for fluid mineral resources have been approved in this area.

## **Reasonably Foreseeable Future Actions**

- # *BLM Actions Per Year* As summarized in Table 4-11 below, BLM estimates that there are approximately 356 acres disturbed each year due to miscellaneous actions.
- # *Proposed RMPA/FEIS for New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management* This Proposed RMPA/FEIS was released in January 2000. The Proposed Statewide RMPA/FEIS documents the effects of adopting standards for public land health and guidelines for livestock grazing management on BLM-administered public land in the State. The standards describe conditions needed for healthy sustainable public rangelands and provide the measure of resource quality, condition, and function upon which the health of public land will be assessed. Changes to existing grazing practices may result to attain the new standards for public land health, based on the need to retain the integrity of the soil and the continued sustainability of ecological processes. The Record of Decision for this project was signed on April 5, 2000. Following the signing of the Record of Decision, the standards and guidelines were sent to the Secretary of the Interior for review and approval.
- # *Copper Flat Mine Project* Alta Gold Company proposes to rebuild and reestablish the operation, expected to produce 16,500 tons per day of copper and molybdenum concentrate. Construction is scheduled to begin in 1999, with mining and milling operations beginning 15 to 18 months later. Operations are expected to continue for 10 years, and reclamation would occur for two to three years later.
- # *Highway 54 Widening* The highway will be widened to four lanes between Alamogordo and Orogrande. This five-year project is currently in the survey and design stages.
- # *Spaceport Initiative* Private industry currently is evaluating the opportunity to site a spaceport or assembly site for a next-generation space shuttle. Two sites of 176,000 acres each are proposed in New Mexico for the project (for which 14 other states also are competing). The New Mexico sites are located near Upham on the border of Sierra and Dona Ana Counties, and about 40 miles southwest of Alamogordo near Orogrande. A Draft EIS was completed for the Southwest Regional Spaceport in July 1997 as required as part of the process for licensing by the U.S. Department of Transportation and Federal Aviation Administration. It is anticipated that a site will be selected in 2001.

Overall, the cumulative impacts for leasing activities are anticipated to be minimal for most resources over the 20-year planning time frame, due to the limited nature of expected surface disturbance unless a substantial amount of development were to occur in one area that has sensitive resource concerns. However, there is potential for cumulative impacts to result in substantive effects on visual resources, wildlife habitat, and water resources. Potential cumulative impacts may be anticipated to occur on

visual resources, wildlife habitat, groundwater levels, surface water quality, and socioeconomic resources, as described below.

Because of the open and undeveloped landscape within BLM's Decision Area, the potential exists for cumulative visual impacts if fluid mineral development occurs in visual proximity to other past, present, or reasonably foreseeable future actions. The greatest concern is if the combination of visual effects of the proposed action and other development were to result in a moderate to strong visual contrast to the setting. The potential for significant effects would be greater if this occurred on BLM VRM Class II or III lands. These types of cumulative impacts may be mitigated through siting and other proposed mitigation measures.

**TABLE 4-11**  
**ESTIMATED SURFACE-DISTURBING ACTIONS PER YEAR**

<b>Type of Action</b>	<b>Average Number of Actions Per Year</b>	<b>Acres of Disturbance Per Action</b>	<b>Average Acres of Disturbance Per Year</b>
Mining notices	7	1.5	10.5
Mining plans of operation	0.5	5.8	2.9
Mineral material sales	45	0.5	22.5
Fences	7	0.6	4.2
Pipelines	5	5.0	25.0
Troughs	10	0.1	1.0
Wells	1	1.0	1.0
Storage tanks	1	0.1	0.1
Prescribed burns	1	2.0	2.0
Wildfires	4	25.0	100.0
Leases 2920	1	20.0	20.0
Permits 2920	2	5.0	10.0
Recreation and Public Purpose Patents and Leases	1	20.0	20.0
Linear Right-of-way	8	15.0	120.0
Site Right-of-way	3	5.0	15.0
Vegetative products removal	0.1	0.0001	0.00001
Erosion control	1	1.0	1.0
Spring development	1	0.1	0.1
Umbrella catchments	1	0.1	0.1
Exclosures	2	0.25	0.5
<b>Total</b>		<b>108.1</b>	<b>355.9</b>

SOURCE: Bureau of Land Management, Las Cruces Field Office, July 23, 1999

The volume of road development is not large relative to the existing road network; however, the density or location of new access may have a cumulative effect on a previously undisturbed area. Well spacing in gas and oil fields can suggest the density of road development that may be anticipated. According to the RFD, the three gas fields are expected to have 320-acre spacing, with the total field covering

approximately 6 square miles. Each gas field will contain an oil field developed on 40-acre spacing. Although the associated road networks would not be particularly dense, especially given the existing access in the Planning Area and possibilities for co-location, the cumulative direct and indirect effects may be notable in terms of habitat fragmentation for larger wildlife regardless of which alternative is selected.

Although the water requirements for fluid minerals development are not anticipated to cause significant impacts, the other water demands such as irrigation and domestic needs due to population growth potentially could make even a small water demand a burden to the water system. Water table declines are monitored by the SEO, and the water right allotment and well permit system are in place to ensure that all interested parties have access to their allotted water. However, in the portion of Otero County where an underground water basin has not been declared, this check and balance system may not be present. Declining water levels are of concern to residents of the area. However, fluid minerals development on non-Federal land is not expected to greatly increase the water supply demands in the Planning Area by more than twofold. None of the other potential projects are believed to impact the supply of groundwater resources.

Indirect impacts on surface water quality also can be cumulative in nature because the impact source could include one or more areas. For example, the Rio Grande flows through the western portion of the Planning Area and then flows to Dona Ana County, through New Mexico and into Texas. Incremental impacts of the actions taken within the Planning Area when added to other past, present, and future actions could adversely affect downstream receiving waters.

Development of hydrocarbons or geothermal fluids could produce positive primary and secondary effects on local economies (through employment and purchases of goods and services) as well as generate royalties and tax revenue for state and local governments. The magnitudes, however, would be small; thus, the total positive benefits are not anticipated to produce a significant impact as defined by this study (10 percent increase or recession) based on the level of potential for fluid mineral resources. As a result the adverse impacts associated with stress on communities due to rapid growth is not anticipated as a long-term significant impact. There is no distinction among the alternatives for socioeconomic resources. No mitigating measures are called for, due to the low levels of economic and social impacts likely to be associated with the RFD scenarios.